# Prehistoric Iron Implements from Thailand

*Received July 1973*

PER SØRENSEN

WHILE at least some knowledge is available of prehistoric iron implements from Island Southeast Asia and from Malaysia, very little is known on this topic from the mainland. There are numerous reasons for this deficiency of information on such items of vital importance for the understanding of the early historical periods. A probable major reason is that most iron implements are usually found in a context of bronzes, and the latter have attracted more attention among scholars. To some extent this also seems to be true for Thailand, from where reports so far only briefly mention iron implements (Solheim and Gorman 1966: Pls. VIII*b*, XXIV*d-g*, and XXV; Sørensen 1967: 15, 105, and Pl. 122*n-o*; Watson and Loofs 1967: 262).

With this article it is not, however, the intention to make a compilation of all prehistoric iron implements from Thailand, but rather, as a simple beginning, to give a brief description and evaluation of two small collections which were excavated by the Thai-Danish Prehistoric Expeditions in 1960–62 and 1965–66. Both collections are from Kanchanaburi Province, one from Tam Ongbah on Khwae Yai and the other from the Bang site, Ban Kao, on Khwae Noi (Fig. 1).

## THE ONGBAH COLLECTION

The Ongbah Cave—or Tam Ongbah—is located at long. 98° 57′ E, lat. 14° 41′ N in the hills approximately 10 km west of the district town of Sri Sawat on Mae Nam Khwae Yai. Access to the cave is from a track connecting the Muang Rae Bo Yai lead mines with the boat landing in Sri Sawat. From the track one has to walk about 700 m through rushwood and elephant grass and climb the hillside for another 300 m, before finally reaching the north entrance of the cave (Fig. 2). (For details on Ongbah Cave see Sørensen 1973.)

Per Sørensen is a Fellow of the Scandinavian Institute of Asian Studies and Acting Director of the Lampang, Thailand Field Station of the Institute.

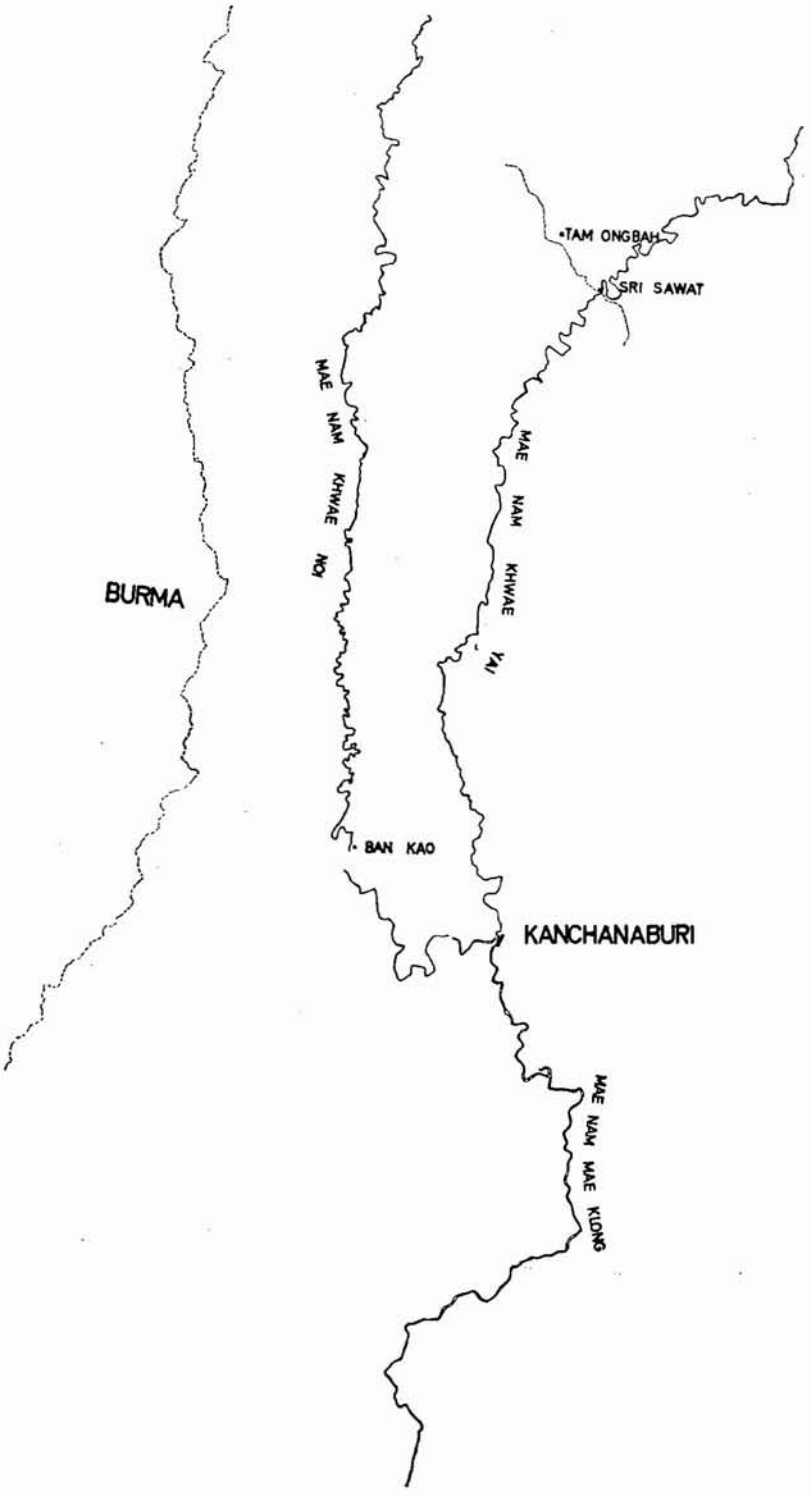



Fig. 1 Map of Mae Nam Khwae Noi and Mae Nam Khwae Yai in western central Thailand.

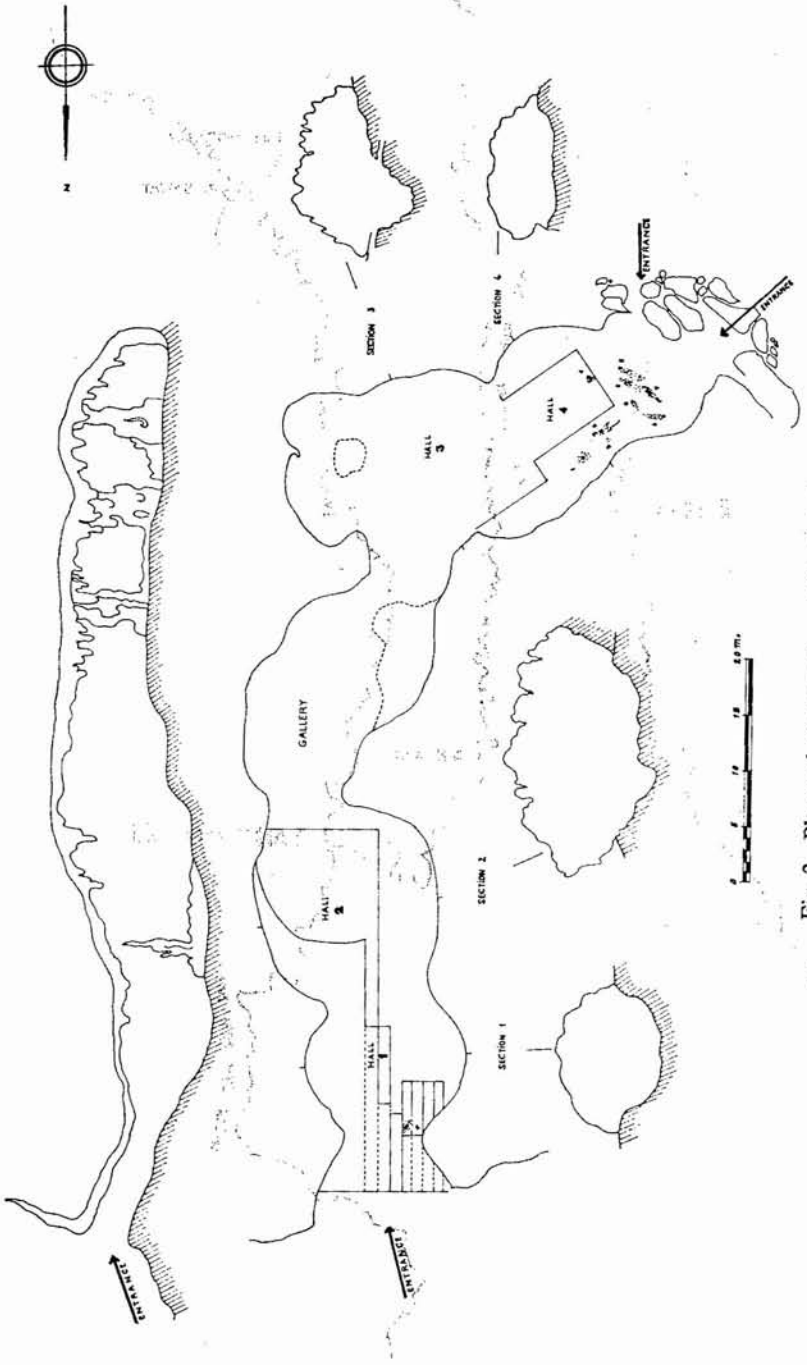



Fig. 2 Plan and cross-section of Ongbah Cave.

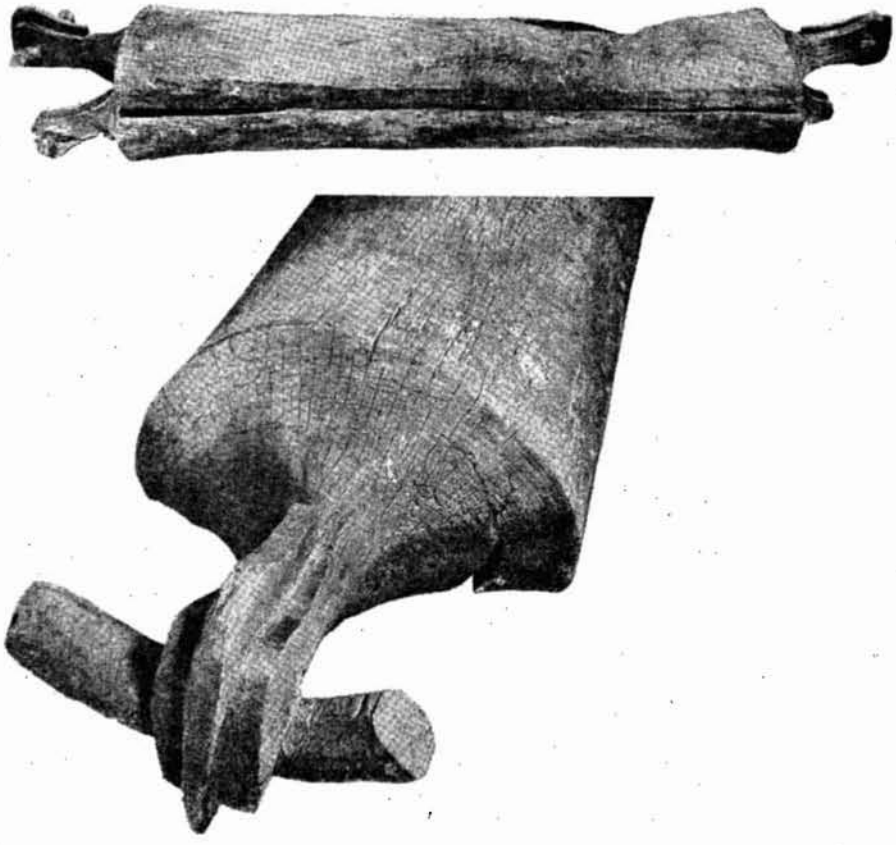


Fig. 3 Carved wooden coffin with stylized animal heads.

Having reached the north entrance of the cave, one finds that it looks anything but impressive. The entrance is low and crescent-shaped, with extensive depositions of soil at and just inside the entrance. Beyond the entrance is a big dome-shaped chamber which is partly divided by stalactites into two rooms, here referred to as Hall 1 and Hall 2. From the left rear side of Hall 2 a narrow passage extends further into the hill. The passage, here referred to as "The Gallery," leads to another big chamber, oriented toward the southwest, and like the first one partly divided into two by stalactites. These rooms are called Hall 3 and Hall 4 (Fig. 2). From Hall 4 there are two openings toward the valley with the track. The smaller one, opening south-southeast, is most certainly of fairly recent origin, while the other crescent-shaped opening toward the southwest may have existed during prehistoric times.

However, this area just inside the southern entrances was covered by big stones, partly fallen from the roof, partly originally having covered the south-southeast entrance. The stones are probably a main reason for the cave deposits remaining intact here, while otherwise most of the cave had been subject to diggings by local farmers and on several occasions ransacked by treasure hunters. Another area of intact deposits was in and just behind the north entrance of the cave, and minor undisturbed areas were found along the walls.

Originally a deposit of varying thickness covered most of the 98-m total length of the cave. It is roughly divisible into three main horizons:

1. a 10-cm to 20-cm thick, red sandy bottom layer, sterile of finds;
2. a gray sandy layer with stone tools, animal bones, fireplaces and abundant charcoal, of Hoabinhian affinity, 50 cm to over 2 m thick; and
3. a 50-cm to 1-m thick, generally hard consolidated brown topsoil, which could be further subdivided stratigraphically by means of thin white horizontal lines, resulting from periodically more intensive deposition of calcareous material from the roof.

In the following paragraphs we shall be concerned mainly with the third horizon, from which the finds to be dealt with were either excavated or derived. Most outstanding among these finds were the wooden coffins.

## The Wooden Coffins

The treasure hunters' ransacking of the cave had left everything in chaos. Complete or in fragments, there were altogether more than ninety wooden coffins piled up at various places or just left in the middle of heaps of soil or empty in what appeared to have been their original find spot. From this and from the many observations made in the course of the excavation, it seems as if during prehistoric times coffins had been placed all over the cave, with marked concentrations in the darkest places. It can definitely be stated that the coffins had no specific orientation.

The coffins are boat shaped, being in fact simple and ordinary dugouts. At both ends they have stylized animal heads, the horns of which at the same time have acted as handles (Fig. 3). The coffins are made of hardwood, one of the abundant *Dahlbergia* sp. This partly accounts for their good state of preservation, even to

recognizable tool marks still being found on several coffins. In some cases it appears that one coffin served as the lid of another, the upper and lower part showing tongue-and-groove joints. Usually, however, the coffin consisted of only half a trunk with a cover of plain boards. The average total length of the coffin is between 3 and

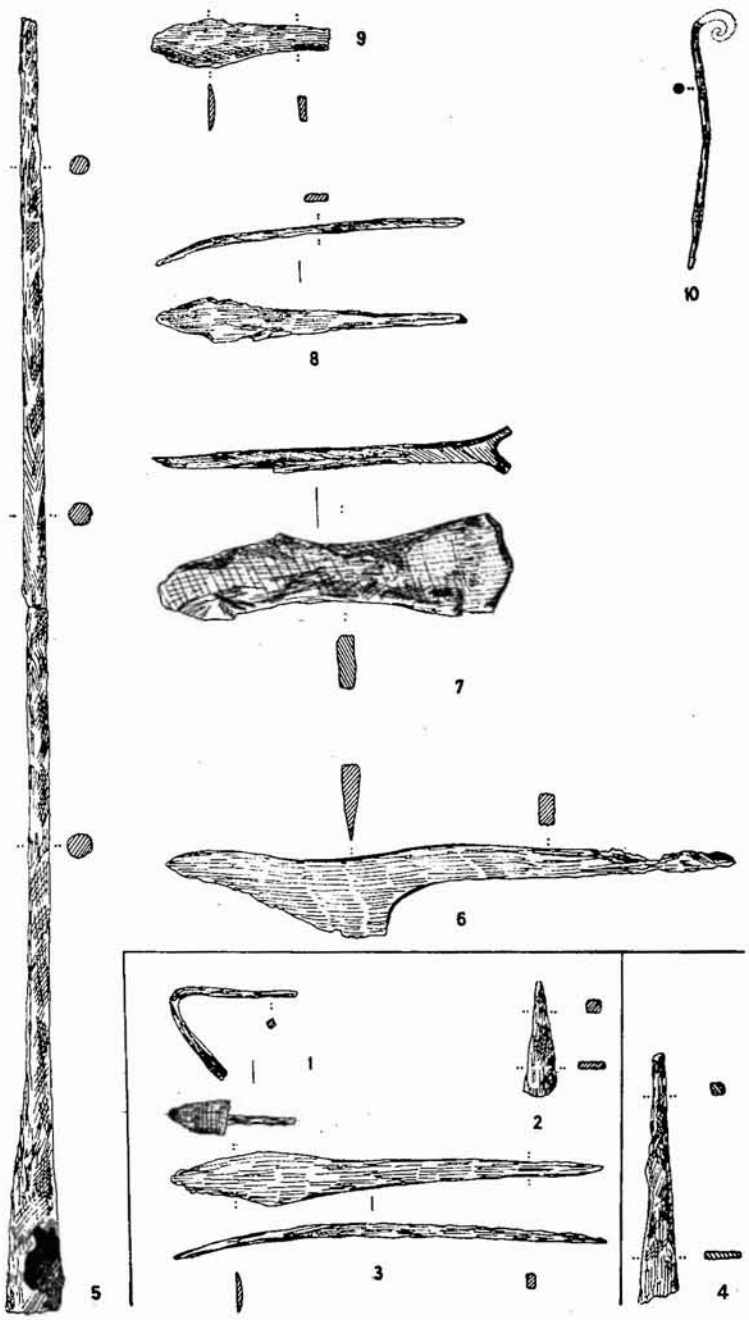



Fig. 4 Iron artifacts from Tam Ongbah.

3.5 m, while the dug-out interior chamber is about 2 m long. In this chamber the body had been inhumed supine, probably in full dress with strings of beads around the body, bead necklaces, bronze and silver? ornaments such as spiral armrings, bronze vessels (Fig. 22*b*), iron weapons and tools, and pottery, particularly miniatures.

Unfortunately, no coffin was discovered completely intact. The foregoing information was gathered from and ascertained by questioning some of the labor staff, who had also been working for the treasure hunters, and was verified by the semi-intact coffins excavated. One coffin, believed to be intact, had been raided probably soon after it was buried in the north entrance. It had been dug into the dark brown top deposit approximately 0.5 m below the then surface of the deposit, which now was covered by another 0.3 to 0.4 m of intact deposit. (The surface of the top deposit sloped both from the entrance toward the rear wall of Hall 2, and from the middle toward the side walls of both Hall 1 and Hall 2.) In the coffin a few human bones were left in what to Sood Sangvichien appeared to be an *in situ* position. One 3-cm long, cylindrical green glass? bead was in the coffin beside the iron implements (Fig. 4). Another coffin approximately in the middle of the "Gallery" had burned during prehistoric times. Part of one side and the solid "horned" stern was preserved, heavily carbonized, covered by 10–20 cm of intact deposit. Several small bright red beads, disc shaped, about 0.4 cm in diameter and 0.2 cm thick, were found in it. Through wood analysis the charcoal samples were recognized as *Dahlbergia* sp., and C-14 dating yielded a result of 2180 ± 100 B.P. or 230 B.C. (K. 1300). A third coffin, placed along the east wall of Hall 3 just after the "Gallery," was partly rotted away. In it still were three iron implements (Fig. 4, *1–3*), apparently in an *in situ* position between the almost dissolved cover boards and the bottom of the coffin. Several other iron implements were found in what could be *in situ* position in coffins, but owing to uncertainty because of the severe disturbances of the cave, they are here classified as stray finds from the cave. The same applies to several other beads, bronze fragments, bracelets, bronze armrings, and bronze spiral armrings.

## The Simple Burials

In the intact deposit inside the southwest entrance and along the northwest wall of the cave in Hall 4, ten simple interments were excavated (Fig. 2, Fig. 5). Of these Burial 1 is undated; Burial 2 is that of a child, probably interred together with Burial 3, which like no. 4 through their associated burial gifts of pottery can be clearly related to the Ban Kao Culture, but represents a phase later than that known from the Bang and Lue sites in Ban Kao (Sørensen 1973). Similar pottery is known from Nong Chae Sao, Changwat Radburi, and from the North Malaysian sites (Sørensen 1972: 466; Peacock 1959). Burials 5–10 (Figs. 5–16) were associated with iron implements and in the case of Burial 10 also with a few sherds of a vessel, distinct from the neolithic wares found in the cave. Inhumed supine in different directions, they were placed directly on the floor of the cave, on the average covered by 0.5 m of deposit. A similar simple interment, Burial 11, was in the brown topsoil just inside the north entrance to the cave, placed slightly above the gray sandy "Hoabinhian" deposit and covered by 0.5 m of soil. It was parallel to and in close

proximity with the semi-intact wooden coffin mentioned earlier, and was also associated with iron implements (Fig. 2).

These simple interments are in sharp contrast to the seemingly richly furnished coffin burials. Inferior social status rather than chronological differences seems to be the logical explanation of the difference, since the iron implements found with both groups of burials are similar.

Before the disturbances of the cave, there were undoubtedly similar simple

Fig. 5 Plan of the burials inside the southwest entrance and in Hall 4.

interments all over in the floor, these probably accounting for several of the stray iron implements that were found. The same of course applies to the late neolithic burials, to judge from adzes and pottery found abundantly in the soil heaps left by the treasure hunters, who ultimately were out mainly for the more valuable items, such as the beads, but who of course also gathered unbroken items of bronze.

## Iron Implements from the Deposit

The top deposit in Ongbah Cave was beautifully stratified yet very complex, due to the many interments dug into it. The interments had of course caused disturbances in the stratification, and are probably a main reason why the dating of charcoal samples collected from these layers provided the same confusing chronological picture as Solheim apparently was facing at Non Nok Tha (Solheim 1968: 59–62). A more cautious approach and attitude toward the C-14 dates of Non Nok Tha is represented by Bayard (1970: 130). Thus the deposit along the west wall in Hall 4, Layer 2 (counting from the top of the deposit) contained melted bronze nodules, ashes, and lots of charcoal, which C-14 dating showed to be 4240 ± 100 B.P. or 2290 B.C. Layer 5 was dated at 3960 ± 100 B.P. or 2010 B.C. (K. 1298, K. 1299). The vertical distance between the layers at the point of sample collecting was about 30 cm. In Hall 1 the top of Layer 7—the uppermost of the "Hoabinhian" layers—was dated 9350 ± 140 B.P. or 7400 B.C. Undoubtedly it is charcoal from this layer that has caused the contamination. These datings accordingly have to be discounted. Confirmation of the above theory was actually found in connection with the excavation of Burial 11 in the north entrance. Here it was clearly visible from which layer the body had been dug down, where the dug-up soil had been placed and how it, on covering the body, had provided a mixed soil that included elements from the "Hoabinhian" layer underneath. Also here and at various other places it was noticed that vertical pockets in the deposit unquestionably were postholes. So some markings seem to have been at the then surface of the deposit, where interments had already taken place (cf. Sørensen 1967: 65). On the other hand, the surface marking of burials by posts may have contributed further to the contamination of higher layers in the deposit, thus affecting the charcoal samples collected for datings.

Scattered in this upper brown deposit were found iron implements of different types, but without any relation to burials. Since most of the tools found in the deposit are suitable for carpentry, it appears logical to think that at least part of the manufacturing of the wooden coffins may have taken place in the cave.

## Stray Finds

Many iron implements were found in the earth heaps left by the treasure hunters. Other implements were carefully gathered at a stalactite flow-out area, which the local population regard as an altar. Here also were placed fragments of bronze spiral armrings, fragments of bronze-covered armrings of stone, and fragments of a bronze cup. Elsewhere in the cave fragments of four bronze kettledrums of Heger Type 1 (Sørensen 1973) were recovered. While the bronzes most certainly can be said to originate from the wooden coffins, as mentioned earlier, the stray iron implements

may originate from any of the three categories of finds described above—the wooden coffins, the simple interments, or the deposit. Accordingly they can be credited with typological value only. Everything else considered, the main scientific interest lies primarily with the items found with the simple interments. Therefore these shall be described briefly.

## Description of the Simple Burials and their Associated Iron Implements

### *Burial 5* (Figs. 5–7)

Found in Hall 4 nearly at a right angle to the right wall, with a geographical orientation close to southeast-northwest. It appeared to have been buried in a strongly flexed position with the head resting on the left side, facing the entrance. However, during excavation it turned out that several joints had been dislocated, and not all of the bones were in their correct place. Yet with all of the bones present and the spinal column intact, it seems more logical to regard the body as having been buried in a somewhat decomposed stage rather than as representing a secondary burial.

Some animal bones and a sherd immediately above the skeleton cannot be related to the burial with sufficient certainty to be regarded as burial gifts. On removal of the skeleton, however, an iron hoe was discovered, the tang of which was parallel to the right tibia and the blade in front of the knee.

*Find 1* (Fig. 7)

Iron hoe, triangular blade, and rounded bit in transverse position to and at obtuse angle with the circular-sectioned tang. Total length 24.5 cm, height of blade 12.5 cm; width of blade at bit 6.2 cm; diameter of tang 1.5 cm.

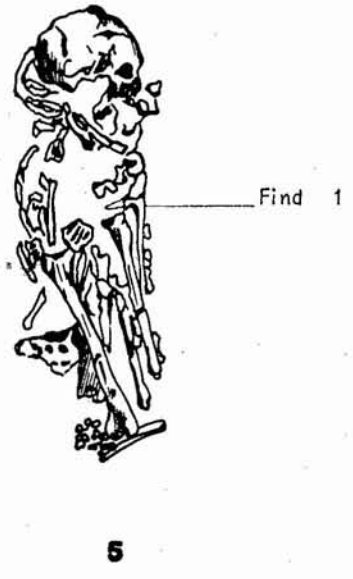



Fig. 6 Burial 5.

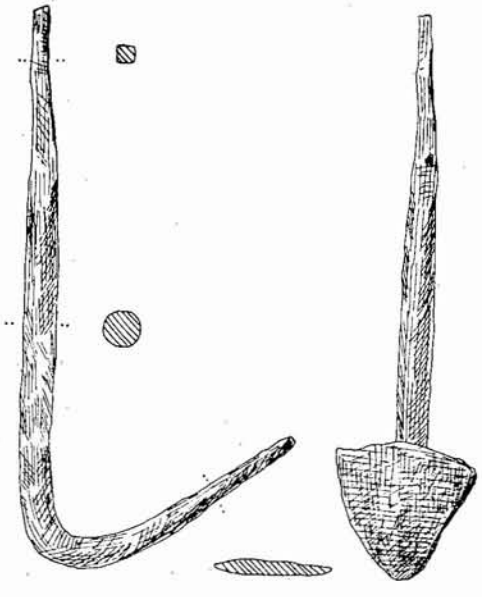


Fig. 7 Hoe associated with Burial 5 (X 1/3).

*Burial 6* (Figs. 5, 8, and 9)

Found in Hall 4 in supine position, parallel to and close to the right wall, extended southwest to northeast with head slightly turned north and face up, resting on the floor of the cave. It was fairly well preserved and complete. Four burial gifts were found with the skeleton.

*Find 1* (Fig. 9,*3*)

Spatula-shaped iron implement, perhaps a knife. Long narrow blade apparently with edges along both of the long sides, and short, square-sectioned tang. Placed slightly above the left hand. Length 21.2 cm; width of blade 1.4 cm; tang 0.45 by 0.45 cm.

*Find 2* (Fig. 9,*1*)

Single-edged iron knife. Back of blade slightly curved. Tip lacking. Blade slightly bent. Rectangular-sectioned 9-cm-long tang. Situated along inner side of the left femur. Length 17.7 cm; width of blade 1.9 cm; tang 0.3 by 0.45 cm.

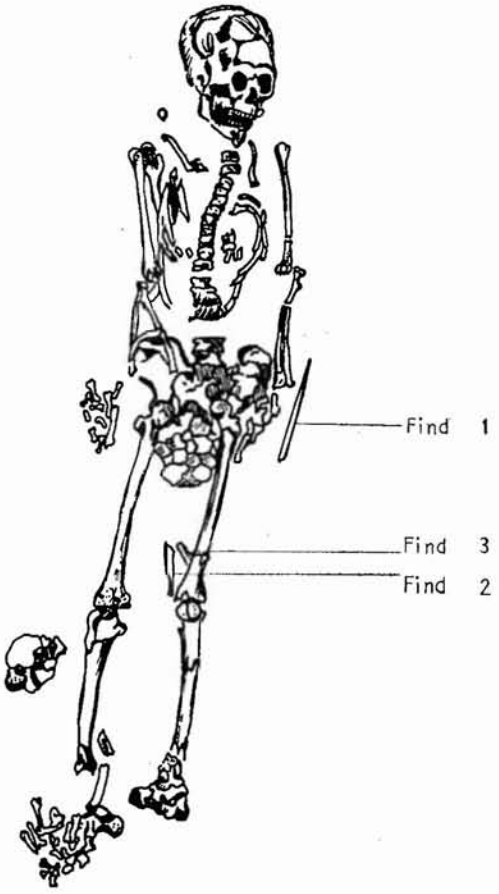



Fig. 8 Burial 6.

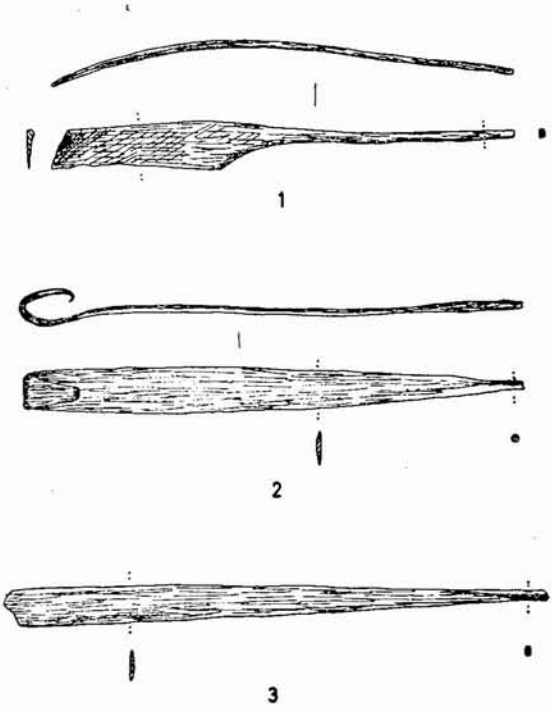



Fig. 9 Artifacts with Burial 6 (X 1/3).

*Find 3* (Fig. 9,*2*)

Spatula-shaped double-edged iron tool, perhaps a spear, with tip bent around twice as if "killing" of tool was intended. Short circular-sectioned tang. Found next to Find 2, with the bent tip under left femur. Length 19.6 cm; width of blade 1.8 cm; diameter of tang 0.3 cm.

*Find 4*

A collection of five small beads was uncovered at the lower left side of the neck. (No details or drawings of beads are included in this paper. These items are all kept at the National Museum in Bangkok.)

*Burial 7* (Figs. 5, 10, and 11*A*)

Found in Hall 4 in supine position, at an obtuse angle to the right wall, but parallel to the southwest entrance. The skeleton was extended east-southeast to

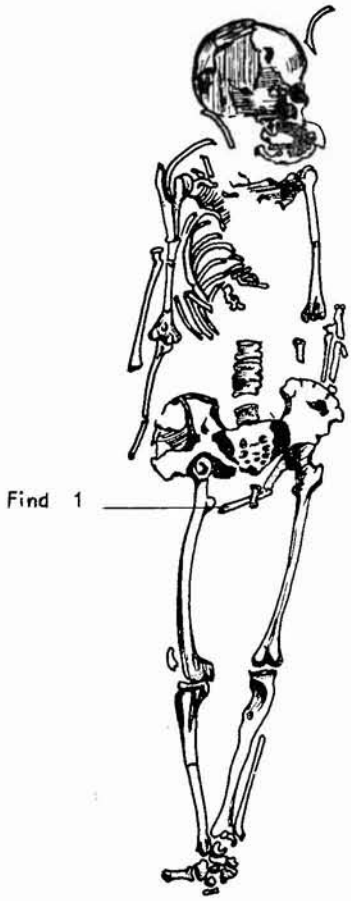



Fig. 10. Burial 7.

west-northwest. The skull had a slight turn to the left but was face up. It was slightly distorted, especially around the left side of the thorax. It is most likely that the body of Burial 7 was interred contemporaneously with those of Burials 8 and 10. One iron implement was associated with the burial.

*Find 1* (Fig. 11*A*)

Iron chisel, almost complete, but with a slight longitudinal bending. Circular-sectioned tang continuing uninterruptedly into the trapezoidal blade. Bit rounded. Found between the legs just below the pelvis. Length 12.7 cm; width of edge 3.2 cm; diameter of tang 0.9 cm.

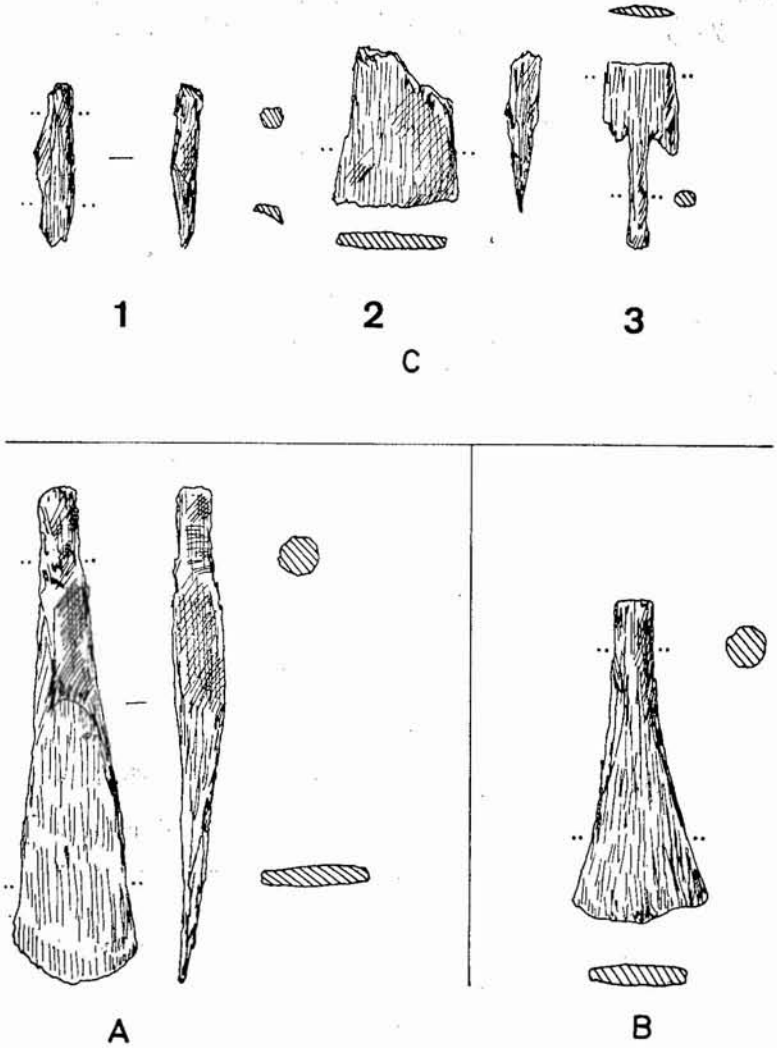



Fig. 11 Artifacts associated with *a*, Burial 7; *b*, Burial 9; and *c*, Burial 11 (X 1/2).

*Burial 8* (Figs. 5, 12, and 13)

Found in Hall 4 in supine position, extended almost east to west with the head turned to rest on the right side facing north, that is, into the cave. The skeleton was in poorer condition than the drawing indicates. Except for the ribs, most of bones were present, yet they showed an extremely high degree of dissolution. Among the simple interments this must be regarded as the body of a more wealthy person, judging from the quantity of the burial gifts which were all neatly arranged at the foot of the burial. The gifts are described below (Fig. 13).

*Find 1*

An iron arrow. Complete except for tip of one barb. Flat triangular head from the rear corners of which extend two short barbs. Cylindrical-sectioned long tang, which shortly beyond the barbs is wound with iron wire. Placed along the right foot

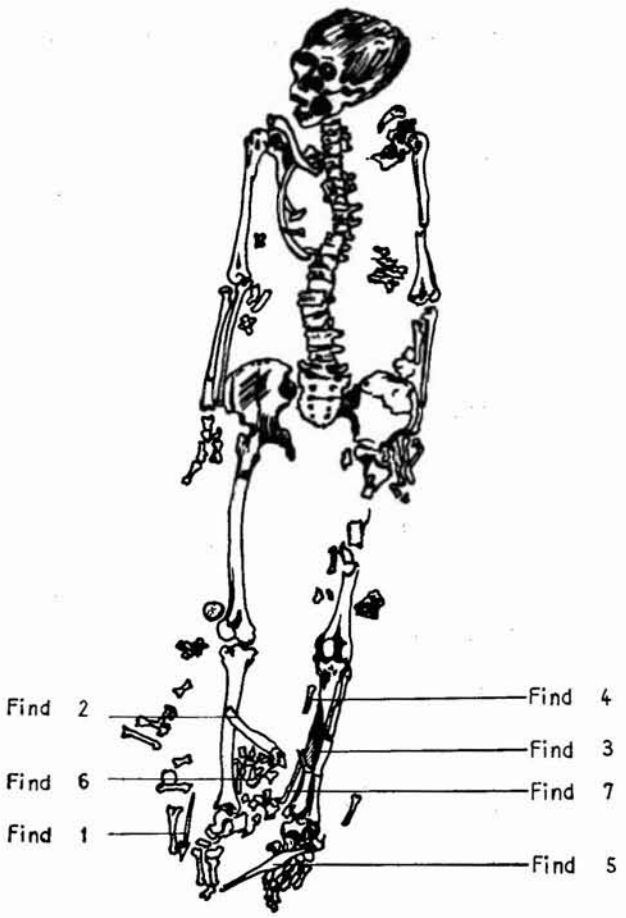



Fig. 12 Burial 8.

pointing away from body. Total length 14 cm; length of tang 11.5 cm; width of head 1.3 cm; diameter of tang at wire 0.65 cm.

*Find 2*

Iron chisel, complete, heavy. Cylindrical tang clearly separated from the high trapezoidal blade with rectangular section. Placed across the right tibia. Length 15.5 cm; width of bit 3.0 cm; thickness of blade at middle 1 cm; diameter of tang 1.15 cm.

*Find 3*

Lancet-shaped blade with bent tip. Tang missing. Appears to be double-edged. May have been knife for woodworking or "killed" spearhead. Placed parallel to the left tibia. Length 14 cm; width of blade 3.15 cm; thickness of blade 0.25 cm.

*Find 4*

Fragment of iron tool, probably tang from some implement. Circular-sectioned tang. Found close to Find 3, parallel to the left tibia. Following cleaning and

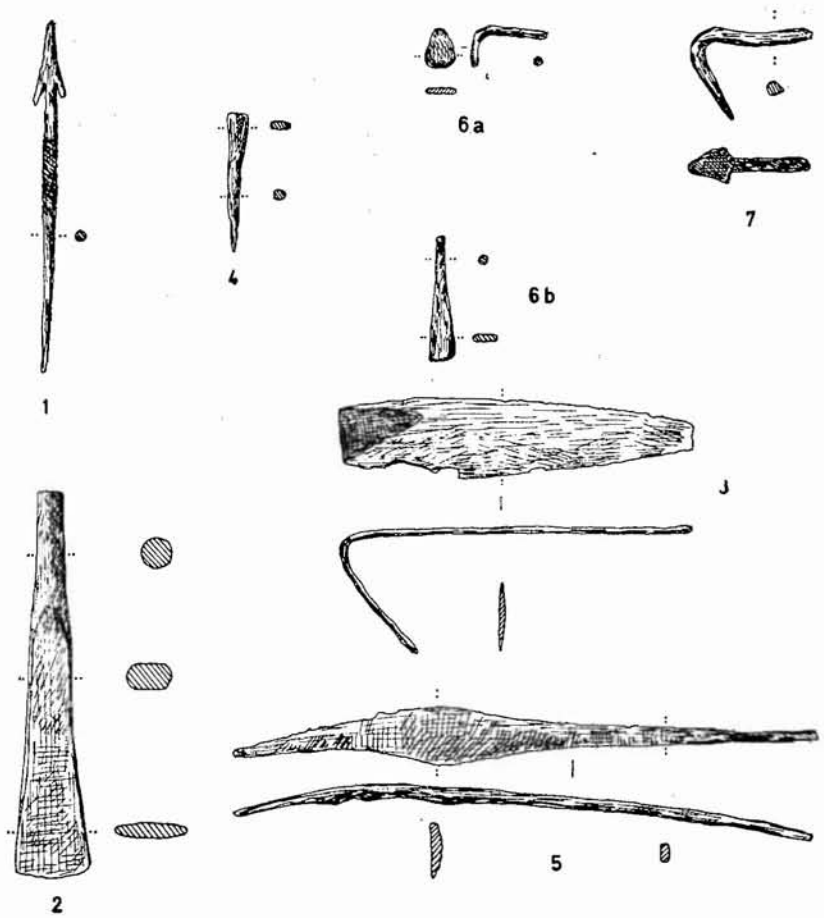



Fig. 13 Artifacts with Burial 8 (X 1/3).

conservation the piece could be joined to the tang of Find 3, which accordingly must have been a spearhead. Length 5.5 cm; diameter 0.55 cm.

*Find 5*

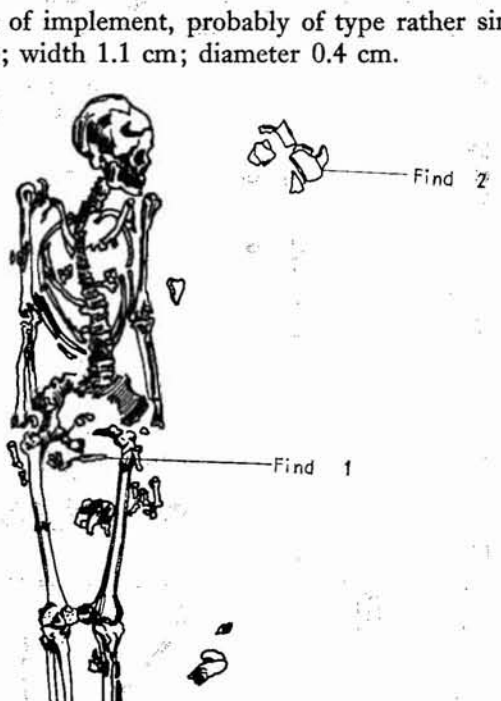
Single-edged iron knife with 12-cm-long rectangular-sectioned tang. Back of blade blunt, curved. Edge ground and worn into concave shape, leaving tip of blade pointed. The blade, which is slightly bent longitudinally, has probably been used for woodworking or leatherworking. Placed across left foot. Length 23.3 cm; width of blade 2.3 cm; thickness of blade 0.4 cm; tang 0.8 by 0.45 cm.

*Find 6a*

Miniature "hack" with short cylindrical tang at a right angle to the short triangular head, which has rounded corners. Found together with Find 6*b* between slightly distorted bones of the right foot. Length 3 cm; width of blade 1.3 cm; diameter of tang 0.45 cm.

*Find 6b*

Fragment of tang and blade of implement, probably of type rather similar to Burial 6, Find 1. Length 5 cm; width 1.1 cm; diameter 0.4 cm.




9.

Fig. 14. Burial 9.

*Find 7*

Miniature "hack" with "swan-neck-shaped" tang. Blade in transverse position to tang and at obtuse angle with it. Bit damaged. Found parallel to left tibia. Length 4.9 cm; width of blade 1.5 cm; diameter of tang 0.5 cm.

*Burial 9* (Figs. 5, 11*b* and 14)

Found in Hall 4 in supine position, extended east-southeast to west-northwest with the head turned south facing the entrance. Like the skeleton of Burial 8 this was rather dissolved, but with most bones present. In front of the face were a few sherds from a vessel (Find 2), which like the beads are in the custody of the National Museum, Bangkok.

*Find 1* (Fig. 11*B*)

Small chisel with short cylindrical tang, which uninterruptedly continues in the high triangular blade. Slightly curved bit. Found placed immediately below the pelvis.

*Burial 10* (Figs. 5 and 15)

In Hall 4 between Burials 8 and 9 was a scattered collection of human bones. It is most likely that we are here confronted with an older burial that was disturbed during the burying of skeletons 7 to 9, or by any of these if interment of them was carried out individually. No gifts were associated with Burial 10, but a small shouldered stone adze, found 40 cm from the right hand of skeleton 7, may have originated from this burial.


Fig. 15. Burial 10.

*Burial 11* (Figs. 11*c* and 16)

Found in Hall 1, Trench B, Meter 5.0–5.5 with extension into Trench C was a skeleton in supine position, extended northeast to southwest. The skeleton was

incomplete and in a poor state of preservation. It was just 1 m from the above-mentioned coffin, and a nearby posthole seemingly indicated its location. It had associated two iron implements, which are:

*Find 1* (Fig. 11, *c1* and *c2*)

Tang of iron implement, from its location in the grave probably belonging to the nearby fragment of a small iron chisel *(c2)*.

*Find 2* (Fig. 11*c3*)

Arrowhead, fragmentary with part of head and tang preserved. At the tang, which is broken, a little bit of wiring, similar to that found on the arrowhead of Burial 8, is visible. Part of blade with one barb is preserved. Placed between the knees. Length 4.8 cm; width 2 cm; diameter of tang 0.6 cm.

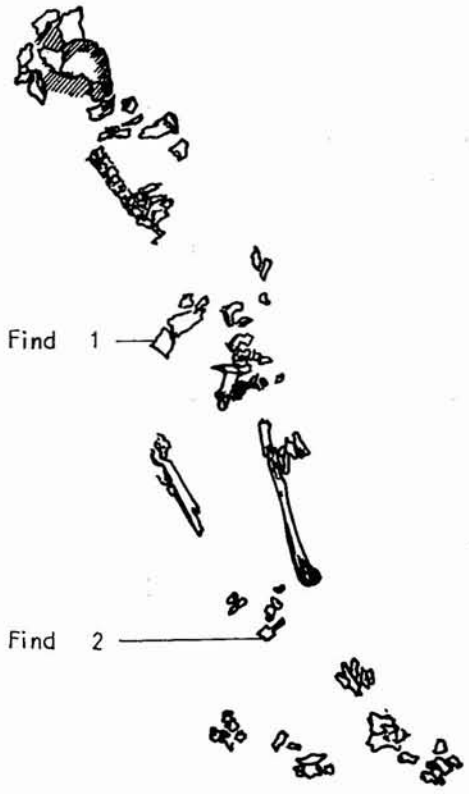



Fig. 16 Burial 11.

Even a brief look at the descriptions and drawings of the instruments discussed here reveals similarities among the tools from the simple interments. This degree of typological correspondence points to their being penecontemporaneous. This observation finds further support when one considers such factors as the general state of preservation of the skeletons, the general state of the preservation of the burial gifts, the proximity of most of the burials with iron implements to each other without apparent disturbance to one another, etc. This similarity between the iron implements from these burials can be further extended to encompass the iron tools from the wooden coffins as well as the stray finds, thus strongly suggesting a certain contemporaneity between the iron implements from Ongbah Cave. The dating of this complex in absolute chronological terms will be discussed at further length below. It suffices here to say that it hardly can have begun later than the third century B.C., to judge from the date of the burned coffin.

## The Ban Kao Collection

At the Bang site, Ban Kao, Changwat Kanchanaburi, two burials having iron implements and further characterized by several other features distinct from those burials associated with stone adzes could be singled out from the majority of the burials excavated at the site. They are already described and discussed elsewhere (Sørensen 1967: 34–35, 45, 85, 88 and 106) and accordingly shall not be dealt with in detail here.

A small quantity of iron implements was also found in the settlement refuse (Sørensen 1967: 15). Generally from the same excavation squares and layers were a few fragments of bronzes, mainly of armrings although the most outstanding was of a small bell (Fig. 22*a*). Judging from the surviving bits, the bronzes are clearly of Dong-So'nian affinity. In general it must be admitted that neither the bronzes nor the iron implements were in a good state of preservation, and that mainly fragments of implements were discovered. In addition, two small pieces of iron slag were found, which might indicate that the tools were made locally. Analysis of the iron slags showed that the quality of iron was rather inferior, as the slag contains $P_2O_5$.

| | | | |
|---|---|---|---|
| FeO | 0.05% | CaO | 33.7% |
| $Fe_2O_3$ | 2.14% | $Al_2O_3$ | 6.4% |
| MnO | 0.13% | MgO | 4.8% |
| $SiO_2$ | 48.8 % | Cu | 0 |
| | | $P_2O_5$ | 0.376% |

This might account for their poor state of preservation. The most important pieces found are (for excavational data see Sørensen 1967: 13 and Maps 3, 4):

1. Square E.2, Layer 5 (B.D. level 182–97): A piece of iron slag.
2. Bank E.2/E.3, Layer 4 (B.D. level 170–85): A fragment of an iron chisel with short cylindrical tang and part of a rectangular-sectioned blade (Fig. 17*c*). Length: 4.5 cm; sides of blade: 1.6 by 1 cm; diameter of tang: 1.2 cm.

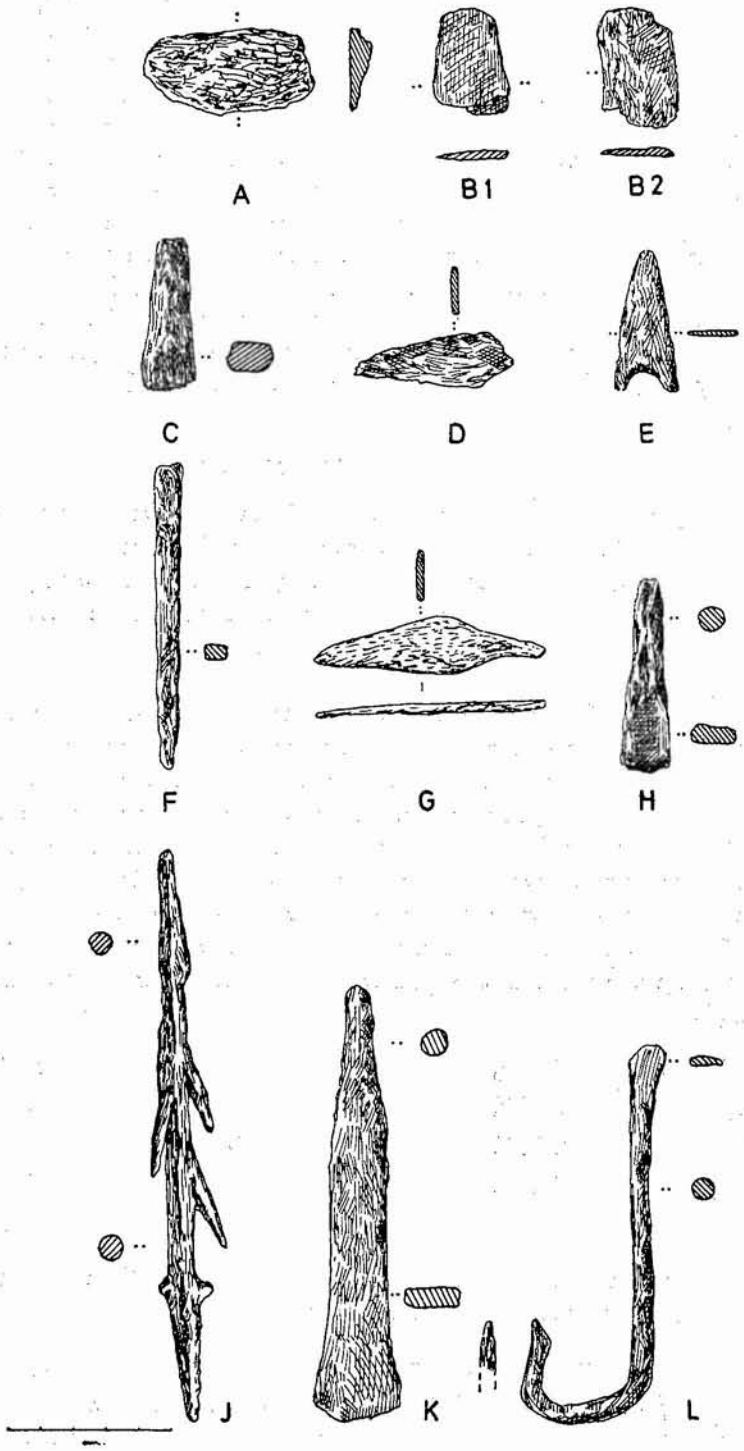



Fig. 17 Iron artifacts from the Bang site at Ban Kao, Kanchanaburi.

3. Square E.3, Layer 5 (B.D. level 185–200). Two pieces: (a) A fragment of an implement (Fig. 17*f*). Rectangular-sectioned tang, to judge from Ongbah evidence, probably from a knife. Length: 9.3 cm; sides of tang: 0.65 by 0.8 cm. (b) Fragment of chisel (Fig. 17*h*). Short cylindrical tang and rectangular-sectioned blade. Length: 5.9 cm; sides of blade: 1.4 by 0.5 cm; diameter of tang: 0.8 cm.

4. Square F.2, Layer 7 (B.D. level 206–21). Three pieces: (a) A piece of iron slag. (b) Two small rectangular pieces of iron (Fig. 17*b*), each probably being the rest of rice reaping knives. Sizes: 3.6 by 2.2 cm and 3.2 by 2.3 cm.

5. Square E.2/F.2, Layer 3 (B.D. level 146–61). A big fishhook (Fig. 17*l*) made from a piece of thick cylindrical iron wire, hammered flat at one end to secure fastening of string, U-shaped hook, cut obliquely, perhaps originally exhibiting an inside or outside barb. Length: 11.5 cm; diameter of stem: 0.6 cm.

6. Square F.3, Layer 5 (B.D. level 176–91). A small angular piece of iron, the hook probably from either a fishhook or from a spearhead. Length: 1.8 cm; internal length of hook: 0.7 cm.

7. Square G.2, Layer 5 (B.D. level 173–88). Two pieces: (a) Edge fragment of big adze (Fig. 17*a*). Width of edge: 5.2 cm. (b) Chisel, complete. Cylindrical short tang, uninterruptedly continuing in the high rectangular-sectioned blade. Edge corners slightly outturned. Bit slightly rounded (Fig. 17*k*). Length: 13.3 cm; width of edge: 2.7 cm; sides of blade: 1.6 by 0.7 cm; diameter of tang: 0.7 cm.

8. Square G.2, Layer 6 (B.D. level 188–203). A small broken-tanged knife, probably for rice reaping purposes. Cylindrical-sectioned tang, rectangular-sectioned blade. Edge not discernible (Fig. 17*d*). Length: 6.5 cm; width of blade: 1.6 cm; diameter of tang: 0.5 cm. Bank F.2/G.2, Layer 5 (B.D. level 174–89). Two pieces: (a) A small complete knife with short rectangular-sectioned tang, and triangular blade with slightly incurved edge. Single-edged (Fig. 17*g*). Length: 6.9 cm; sides of tang: 0.3 by 0.2 cm. (b) Big, almost complete barbed spearhead (Fig. 17*j*) with side knobs at the high part of the triangular stem. Fish spear? Barbs arranged alternately on two sides, the three hind barbs being best preserved, while at least two can be seen to be missing. Length: 17.3 cm; length of shaft end: 3.7 cm; length of barbs: 1.3 cm; diameter of stem: 0.75 cm.

9. Square G.3, Layer 6 (B.D. level 184–99). Arrowhead, triangular shape with slightly convex long sides, and concave, almost semicircular base, leaving two short flat barbs at end of head (Fig. 17*e*). Length: 4.5 cm; width across barbs: 2 cm.

Generally it will be noticed that most items are referred to as Layer 5 or Layer 6. As all excavation layers were 15 cm thick, it is to be assumed that most pieces were in a very narrow horizon centered around the Layer 5–Layer 6 mark. Actually this is partly confirmed by the only piece that I excavated, a small piece of bronze found in Square G.1, referred to as Layer 6, upper third part (i.e., 5 cm under the Layer 5 mark). However, in order to be as accurate as possible, the layers are here also referred to with their B.D. level, as shown in Chart 1, where for convenience the bronze fragments excavated are also included with open symbols. From this it will be noted—as items come from the lower third of Layer 5 or the upper third of

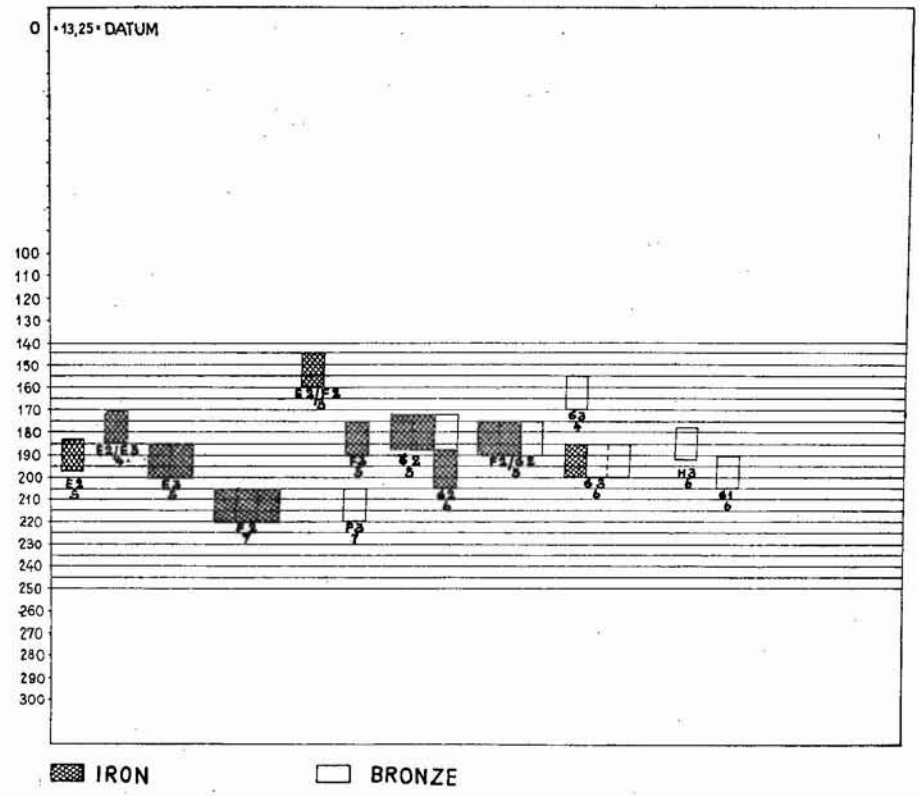



Chart 1 Below datum levels of numbered excavation layers.

Layer 6—that a total of 17 pieces are from a very narrow horizon between B.D. 180–95, while the extremes from Layers 3 and 7 supposedly were there due to the general moving up and down of items, which always can be expected within a settlement deposit.

Sufficient similarities exist between the implement types represented in Ban Kao and in the Ongbah collection to believe that the chronological distance between them—as far as relative chronology is concerned—is rather limited. Unfortunately, the Ban Kao finds can contribute very little if anything to the absolute chronology of the iron implements. This shall be further discussed below. Anyway, the existing similarities between the implement types of the two sites, as they can be read from the foregoing descriptions, are so basic that they allow us to deal with them typologically as a unit.

## Typology of the Iron Implements

Altogether the two collections comprise about 70 implements or implement fragments. The exact figure cannot be given as some fragments might be from the same piece. Of the more recognizable pieces 7 are indeterminable as to type, and another 6 pieces, also from Tam Ongbah, are classified with some uncertainty due to their present state of preservation, but are included below in the survey of the types where the closest identity is found.

In the following classification of the implements an attempt has been made to apply functional names to the types and to group together items of a somewhat corresponding function, such as weapons, woodworking tools, agricultural tools, and fishing tools and other utensils. It has not, of course, been possible to be completely consistent. But since it may be assumed that several types could very well have served various purposes, and as we particularly are deprived of knowledge about the hafting of the tools, it is doubtful if inconsistencies can be avoided. In fact, the main doubts concern the application of the functional names to the different types, and here especially the use of the term "chisel" to describe a quite numerous group of tools of the same general shape, and of a size "supposedly" too small to be characterized as axes, although this is what most of them resemble. On the other hand, the almost ubiquitous damage to the cutting edge may be taken as evidence of their having been used for some kind of hard work, for example, as chisels. The use of this term draws further support from the context, particularly at Tam Ongbah, as extensive woodworking seems to have taken place there. Especially in view of the carefulness and the delicacy of the work, which could be observed on the coffins, a substantial number of different tools may be expected to have been in use, and seem also to be reflected in the material collected there. Accordingly the term *chisel* might be too narrow for the group classified as such, but on the other hand, it is justified in consideration of the doubts mentioned earlier, such as the problem of their hafting. Although considerations such as these have been taken into account in the description and classification of several of the tool types, subjectivity has hardly been avoided, and proposals as to other classificatory terms to be used are accordingly most welcomed.

### *Group I. Weapons*

*Lances* (Figs. 4, 5)

Two connectible fragments of a lance from Tam Ongbah. As a lance should probably be regarded as two fragments of a long cylindrical iron bar, hammered flat at one end and folded round to form a conical socket. The lance may have been barbed. Estimated original length about 80–85 cm; preserved length 58.5 cm; diameter of base of socket 2.5 cm.

*Spearheads* (Figs. 9,*2* and 13,*3*)

From Tam Ongbah Burials 6 and 8. Two leaf-shaped long blades with short tangs. Both apparently purposely "killed" before their being interred with the bodies. The widths of the blades differ, but their shapes are virtually identical. Length 23 and 25 cm.

*Discussion.* Compared to the lance described above and the other weapons to be described below, these spears may seem to be rather weak. The blades are extremely thin and without any midrib or other reinforcement device. However, with the tang and probably part of the blade well inserted in a shaft and provided with a strong wiring, they may have been quite useful for fighting at close quarters.

*Barbed Spearhead* (Fishing spear) (Fig. 17*j*)

From Ban Kao. A strong spearhead, with side knobs at the hindmost part of the stem to prevent it from being pressed into the shaft (of bamboo?) on impact.

Provided with two rows of alternately placed barbs, it may have been less suitable for fighting than for fishing. Length 17.5 cm.

*Discussion.* The similarity of this spear to arrowheads and spearheads from the same locality, made of bone and definitely used to kill human beings (Sørensen 1967: 28, B. 8,7, Pl. 23*a7,* Pl. 125*c*), may indicate a dual purpose and be evidence of a local tradition in toolmaking.

*Arrowheads* (Figs. 11*c2,3*; 13,*1*; 17*e*; and 18*g*)

From Ban Kao and Tam Ongbah. The four arrowheads clearly represent three different types, two with tang and one without tang, all four being barbed.

*Type 1* (Figs. 13,*1* and 18*g*). Two pieces from Tam Ongbah. Triangular long and slender head ending in two barbs. Long tang with wiring behind head. This invention may have been used to screw the arrow into the shaft, thus providing a firm grip and at the same time preventing the arrow from being pushed further into the shaft on impact. One piece was from Burial 8, the other a stray find. Length 14 cm and 13.5 cm (tip lacking).

*Type 2* (Fig. 11*c3*). From Tam Ongbah. Probably originally with long triangular head ending in two barbs at the rear corners, this type has had a short tang only, indicating a different way of hafting from that of Type 1. Original length of blade about 7.5 cm.

*Type 3* (Fig. 17*e*). From Ban Kao. High triangular blade with concave base leaving two short barbs at corners of base. Evidently hafting must have been different from those of both Type 1 and Type 2, probably in a split shaft further fixed with some kind of resin or other adhesive. Length 4.3 cm.

*Halberd* (Fig. 4,7)

From Tam Ongbah. Fragment of a heavy tool with rectangular-sectioned slightly curved blade. No cutting edges visible, but originally probably pointed at one end and having had a socket transverse to the length at the other end. Original length including socket about 18 cm; preserved length 16 cm.

*Discussion.* The present state of preservation of the blade does not allow for any definite statement whether we have here a real halberd (Chinese *Ko*) of the socketed type as they are known from Shih-chai-shan, or if it originally was more like the socketed picks known from the same find. However, the curvature of the blade seems to favor the former interpretation.

*Axes from Tam Ongbah*

*Type 1* (Fig. 19*e*). Rectangular-sectioned heavy blade with socket almost parallel to the slightly curved cutting edge and transverse to the longitudinal section of the axe. One small side of the axe is straight, the other slightly concave. Length 12 cm; width at socket 6.2 cm; width of edge 6.2 cm.

*Discussion.* It is naturally a matter open to discussion whether a tool like this axe should be regarded as a weapon or simply as a working tool. The latter interpretation is supported by the fact that a lot of woodworking must have taken place in or around the cave. On the other hand, traditionally woodworking is done here with transversely edged tools such as adzes, whereas in the present piece we are indisputably confronted with an axe. Furthermore, socketing seems to be rare in both of

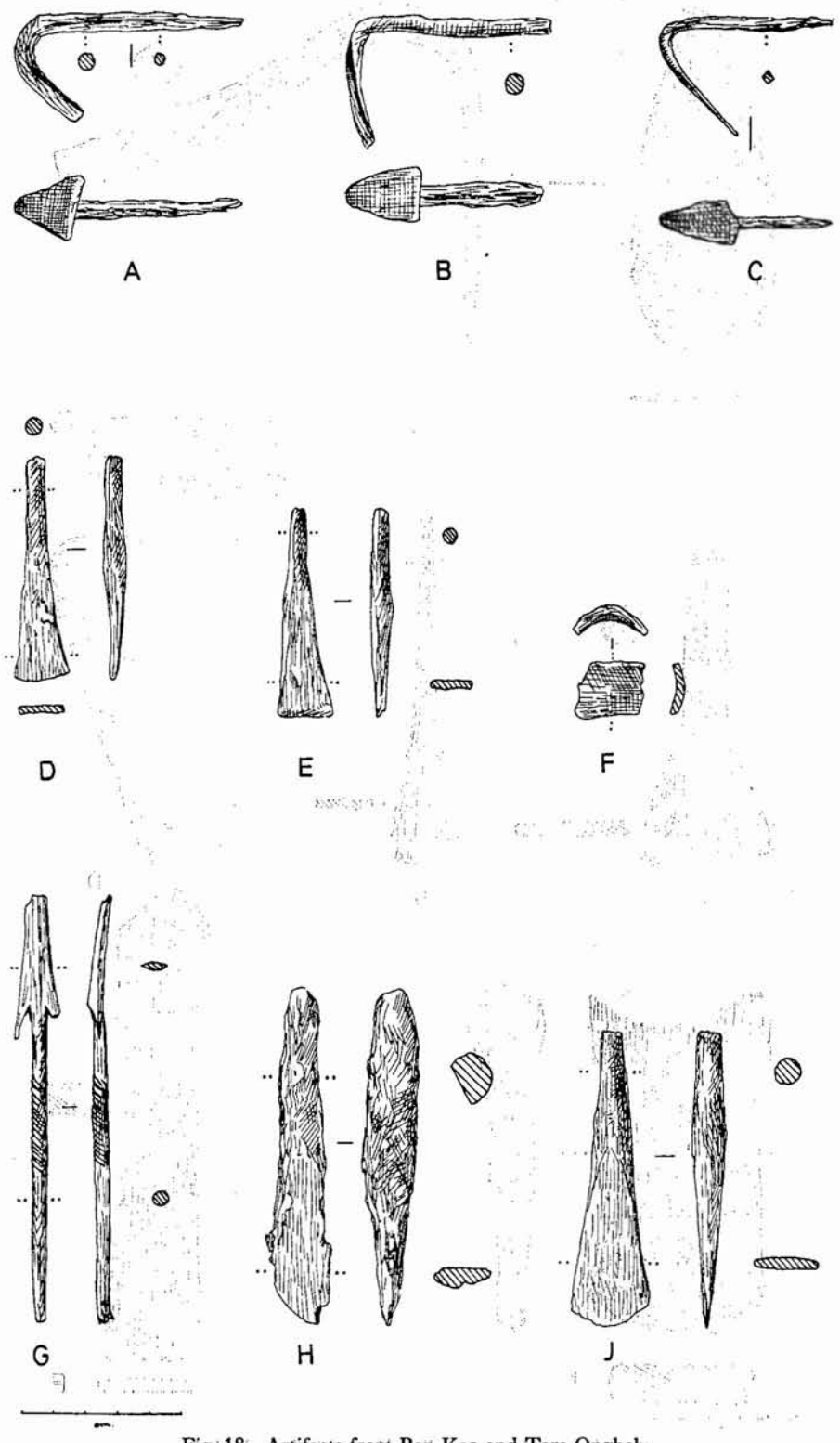



Fig. 18 Artifacts from Ban Kao and Tam Ongbah.

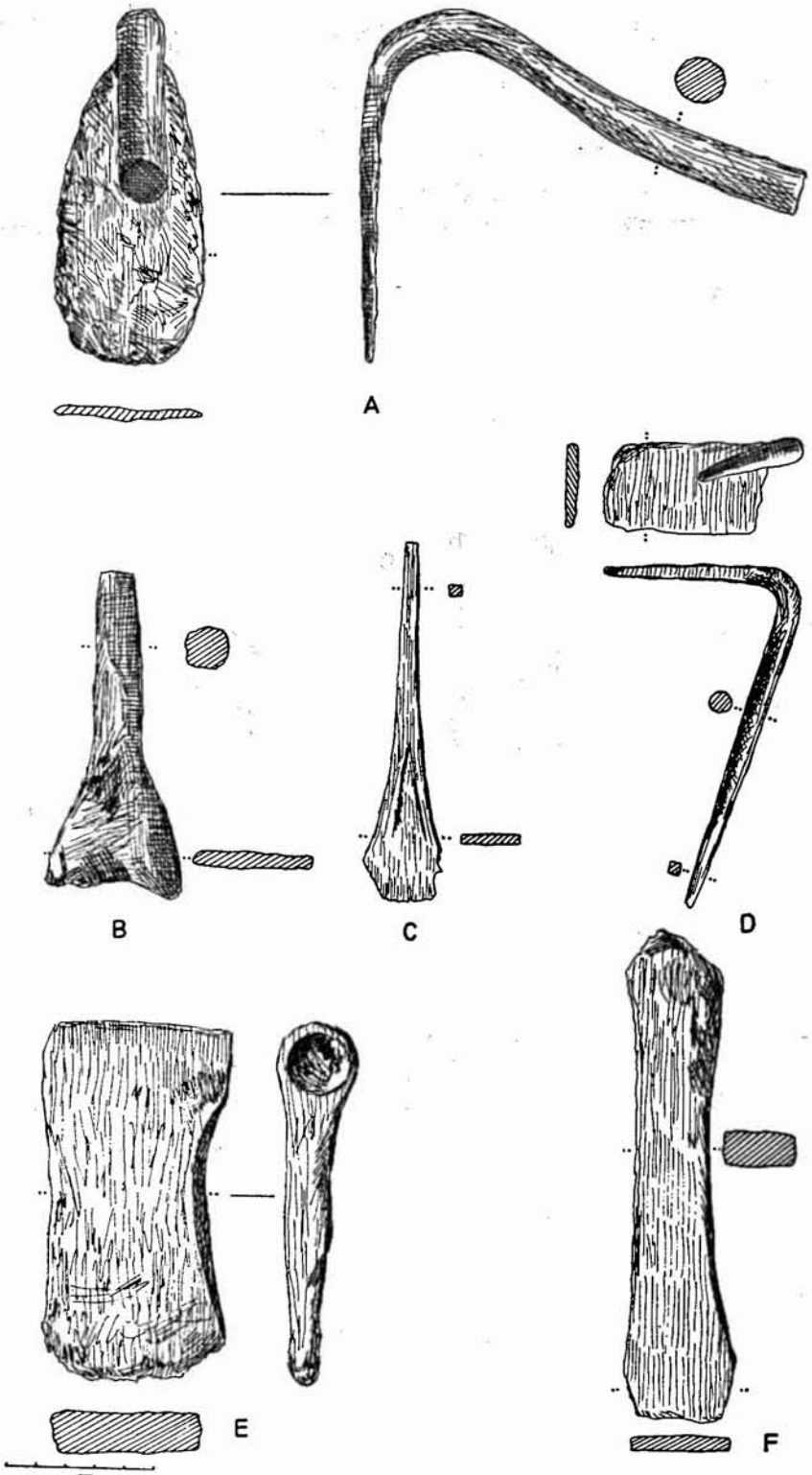



Fig. 19 Artifacts from Ban Kao and Tam Ongbah.

the collections discussed here, and where present, it is found only on weapons. This argument seems to be applicable to the major collections of weapons known from Southeast and East Asia.

*Type 2* (Fig. 19*f*). Rectangular-sectioned, long, narrow, and heavy fragment of an axe blade, the upper small side of which has been straight, the lower one having been slightly concave. The cutting edge is straight, but the corner of the edge toward the concave small side has been outturned, making the axe originally having looked more concave-sided than it now appears. The hind part with the socket is lacking. Original length of the axe cannot be estimated with sufficient accuracy. Length of fragment 16.5 cm; width of cutting edge as preserved 3 cm; original width of cutting edge about 5.5 cm.

*Discussion.* Of course it is unproven that the axe in question was ever socketed. However, from everything that was preserved it is most likely that it originally was rather similar to some socketed axes from Malaysia (Sieveking 1962: Fig. 12*a-c*). Doubtless these Malaysian axes served ceremonial purposes rather than any practical ones. Their sockets are so narrow that they allow only for a rather narrow handle, which compared to the weight of the tools would make them awfully difficult to work with, considering that a reasonable amount of accuracy should be obtained during operation. Their generally poor state of preservation may be due to "killing" of the tools before they were buried.

### *Group II. Woodworking Tools*

*Tanged axe/adze* (Figs. 17*a* and 20*k*)

One from Tam Ongbah, and a fragment from Ban Kao. High conical heavy tang uninterruptedly continuing in the rectangular-sectioned blade. Curved cutting edge with slightly extended corners. Length 23.5 cm; width of edge 5 cm.

*Discussion.* The axe/adze classification simply implies that tools like this can have been used as both, depending on the relationship of the cutting edge to the handle. During the Second Thai-Danish Prehistoric Expedition, the members on several occasions witnessed how, through an intermediate piece of wood, recent socketed axes (Celts) were used as both axes and adzes on the same handle. Similar attachment devices can be supposed to have existed for this type.

*Chisels* (Figs. 4,*2*; 11*a*; 11*b*; 11*c1*; 13,*2*; 17*c,h,k*; 18*d-e,h-j*; 20*a-c,e-j,l-o*).

Chisels comprise a rather numerous group of iron tools, in general all characterized by a short cylindrical tang which continues into the usually high triangular blade of rectangular cross section. Only a few pieces have shoulders; most lack any feature to demarcate the end of the blade and the beginning of the tang. It therefore is rather difficult to further subdivide this group into clearly defined types. However, a few characteristics exist and shall accordingly be set forth as temporary type markers until further knowledge can be extracted from a larger number of specimens.

*Chisels: Subtype 1* (Figs. 11*a*; 11*c1*; 20*a,e,l,m*). A group of six complete or fragmentary chisels corresponding to the above description without any demarcation of tang/blade transition. All are from Tam Ongbah. An additional chisel of this subtype is from Burial B. 23 in Ban Kao (Sørensen 1967: Pl. 122*n*). However, with a slight bending of the blade, eventually featuring a stronger front side bevel than

back side bevel, or having a slightly gougelike cutting edge, these chisels can only have been hafted with the cutting edge transverse to the handle. In other words, they must have been hafted like adzes and probably functioned as gouges. The lengths of the complete pieces vary from 12.8 cm to 14.7 cm. Widths of complete edges are 3.5 cm.

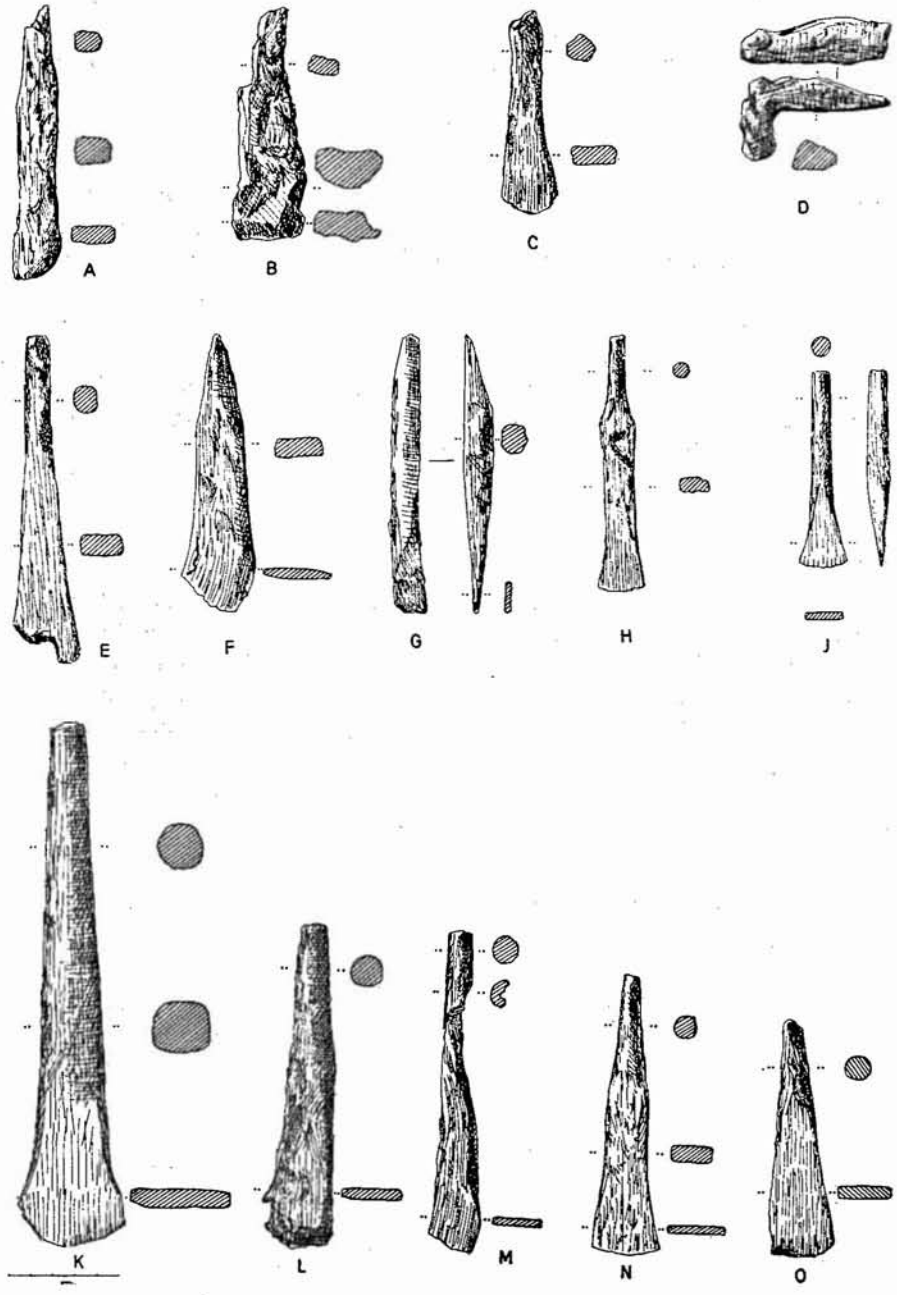



Fig. 20 Artifacts from Ban Kao and Tam Ongbah.

*Chisels: Subtype 2* (Figs. 13,*2*; 17*c,h,k*; 20*h,n*). A group of six complete or fragmentary chisels, which besides meeting the foregoing general description, are characterized by clear shoulders (Fig. 20*h*) or at least have some indication—although it may be faint—of separation between tang and blade. Usually the blades of these chisels are also slightly thinner, with small sides ranging from 0.7 cm to 1 cm, and their contours show slight incurved long sides. The general impression of these chisels is that they are more slender and less heavy than those of Subtype 1. They are all to be classified as having "axe" bits, that is, the cutting edge in a position parallel to the handle. Three pieces are from Tam Ongbah; two fragmentary pieces and one intact piece are from Ban Kao.

*Chisels: Subtype 3* (Figs. 4,*2*; 18*d,e*; 20*j*). A group of four small chisels, all from Tam Ongbah. Although one of them (Fig. 20*j*) seems as if it has never been used, the others are extremely worn, and show completely blunt edges. They are all characterized by a long cylindrical tang (extremely long compared to their general size) and a short triangular blade. Length 5.3–8.8 cm; width of edge 1.6–2.1 cm; diameter of tang 0.4–0.6 cm.

Three other chisels are closely related to the chisels of this group (Figs. 11*b*; 18*j*; 20*o*), although they are bigger than the latter and have a markedly shorter tang. Typologically they seem to be intermediate between those of the first and third subtypes, but show more affinity to Subtype 3.

Finally, three tools exist (Fig. 20*c,f,g*) all of which, due to their present state of preservation and previous wear, are impossible to fit into any of the above groups, and which furthermore are too uncharacteristic for individual classification.

*Iron hoes* (Figs. 4,*1*; 7; 13,*6a* and *7*; 18*a-c*; 19*a*)

The iron hoes can be divided into two groups according to their sizes. Doubtless the big hoes were used during the hollowing out of the interior of the wooden coffins, while the smaller ones were for the more delicate carvings.

*Type 1* (Figs. 7; 19*a*). A spadelike oval blade in transverse position to and at an oblique angle with the cylindrical tang. The latter apparently has been inserted into a wooden handle. Cutting edges now worn but bit apparently originally straight with rounded corners. Both from Tam Ongbah, one from Burial 5. Height of blade 10 cm; width of blade 5 cm; length of tang 13 and 23 cm.

*Type 2* (Figs. 4,*1*; 13,*6a*; 13,*7*; 18*a-c*). A group of six hoes from Tam Ongbah, basically identical to those of Type 1, but smaller. They are approximately of equal size and so much smaller than the former that it is justified to single them out as a separate type. They can be described as follows: a relatively high triangular blade with straight cutting edge in transverse position to the cylindrical tang. Tang and head meet in an oblique angle. The tang may be straight or slightly curved. For the most complete tools the general measurements are: height of blade 3.5 cm; width of edge 1.7–2.0 cm; length of tang 5.0–6.2 cm.

*Wood grooving tool* (Fig. 19*d*)

A rectangular blade with cutting edge at one short side. From the opposite short side left corner a tang extends in an oblique angle with the blade. The purpose of placing the tang in the corner is to leave the rest of the short side space as a striking

platform for a hammer or other beating tool, marks from which are recognizable. Height of blade 5.5 cm; width of edge 3 cm; length of tang 11.5 cm.

*Discussion.* This tool, actually another kind of very specialized chisel, is generally always used for making grooves, particularly where the groove-and-tongue technique is involved. This technique, as mentioned above, was frequently used with the wooden coffins, whether they were covered by simple boards or by another coffin.

*Wood-carving tools* (Figs. 4,*4*; 19*c*)

Two different tools, both indisputably for wood-carving purposes, were also found in Tam Ongbah. The first is a chisel-shaped kind of knife with a short oblique cutting edge (Fig. 4,*4*) and a rectangular-sectioned tang. Length 11.5 cm; width of edge 2 cm.

*Discussion.* This type of tool is evidence of a highly specialized wood-carving technique. It is a type which has remained in use into modern times, and is particularly used by lino and other block cutters.

*Plane iron* (Fig. 19*c*). The other tool also has a rectangular-sectioned tang. The corners of the originally very wide, curved cutting edge are broken off. The center of the blade has a triangular groove on the front side. Length 12 cm; original width of cutting edge 4 cm.

*Discussion.* The function of this tool is more obscure than those of any of the others dealt with so far. However, the combination of the rectangular to square-sectioned tang with the triangular groove in the front of the blade seems to indicate that an extraordinarily firm attachment between the blade and the handle was a necessity. Further, considering the sophistication and specialization among the tools already described, it appears logical to believe that this blade also belongs to a sophisticated tool, e.g., a plane. In other words, the tool described seems to be a plane iron.

### *Group III. Knives*

The knives naturally fall into two main classes: single-edged and double-edged. Within each of these main classes it is possible to separate out further subtypes. They are:

*Type 1. Single-edged knives with straight back* (Figs. 9,*1*; 21*b*,*c*)

Two almost complete and one fragmentary, all from Tam Ongbah, characterized by an oblong rectangular blade with obliquely cut front end and clear heel at back end of cutting edge toward the rectangular-sectioned tang, which almost continues the line of the blunt back of the blade. One knife is from Burial 6, one was excavated in an intact deposit in Hall 4, and one was a stray find. Length of blade 7 cm; height of blade 1.6–1.8 cm; length of tang 7–10 cm.

*Type 2. Single-edged knife with curved blade* (Fig. 13,*5*)

Long rectangular-sectioned tang unmarkedly continuing into the blade, which has a single curved (convex) blunt back. Cutting edge resharpened into marked concave shape. No heel at back of cutting edge to separate it from the tang. The outer half of the blade bent slightly upward. Found in Burial 8. Length of blade about 10 cm; length of tang about 13.5 cm; width of blade 2.4 cm.

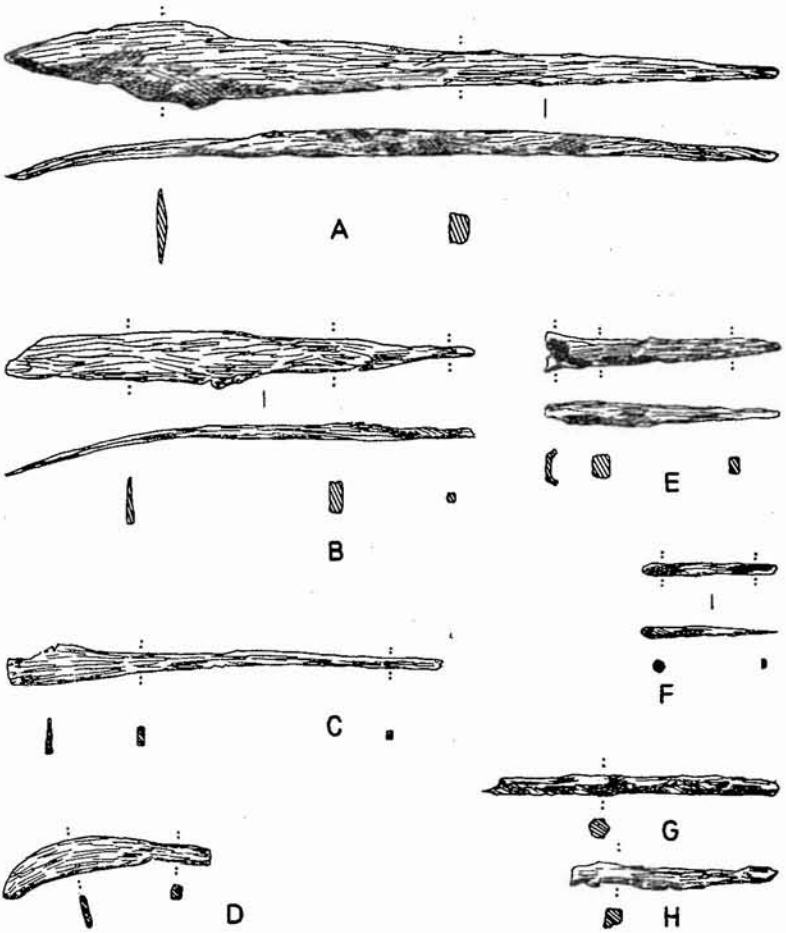



Fig. 21 Artifacts from Ban Kao and Tam Ongbah.

*Type 3. Single-edged knife with double-curved blade* (Fig. 4,*6*)

A stray find in Tam Ongbah, this knife is characterized by a double-curved blade (of slight S-shape) with pointed tip and pronounced heel at the back of the cutting edge, separating this clearly from the long, strong, and heavy rectangular-sectioned tang. The tang is at an obtuse angle with the blade. Length of blade 10.5 cm; height of blade at heel 3.5 cm; length of tang 15.5 cm.

*Discussion.* While the knives of Type 1 are of a fairly light construction (comparable to modern table knives), the single-edged knives of Type 2 and Type 3 are clearly intended for heavy-duty work, as is also indicated by their much stronger tangs. Thus the knife of Type 3 may very well have been used for woodworking, while the knife of Type 2 bears some striking resemblances to certain knives formerly used particularly for cutting leather and thick hides. The slight bending of the blade makes it especially fitted for cutting circular or rounded items.

*Type 4. Double-edged knives with short tang* (Figs. 9,*3;* 13,*6b*)

One almost complete knife and a fragment of a double-edged knife with short tang are respectively from Burial 6 and Burial 8 in Tam Ongbah. The blade is long with straight edges and a rounded tip, and has a lenticular section. The blade almost unmarkedly continues into the short cylindrical-sectioned tang. Length of blade about 16 cm; length of tang about 5.5 cm; width of blade near tip 1.5 cm.

*Type 5. Double-edged knives with bent blade* (Figs. 4,*3;* 4,*8–9;* 21*a*)

The four knives of this type, all from Tam Ongbah, are characterized by a short triangular blade, bent slightly upward in the plane, with a rather flat "lower" side and indications of a midrib at the "upper" side, giving the blade a low triangular cross section. The blade continues smoothly into the long, strong, rectangular-sectioned tang. Length of blade 5–6 cm; length of tang 15–17 cm; width of blade near tang about 2.5 cm.

*Discussion.* The double-edged knives of Type 4 bear some resemblance to the leaf-shaped spearheads described above. However, these knives always had a rounded and never a pointed tip, and their cross section differs from that of the spearheads. Because they are double-edged it is hard to interpret them as being anything but knives, even if it is most difficult to determine what purpose they might have served.

The Type 5 knives might also at first glance look like spearheads, the bending of the blade then representing attempted "ritual killing." However, the bending of these blades is so identical that this characteristic more nearly indicates a part of the function rather than an arbitrary bending in connection with "killing." The uniform blade shape, the strong tang, and other details all point to their having been used for some kind of heavy work, most likely some kind of woodworking. Furthermore, this type of tool is found in modern tool kits for wood engraving.

A total of five fragments of tangs, one from Ban Kao and four from Tam Ongbah, bear the most resemblances to the tangs of knives, but cannot be incorporated into any of the foregoing groups.

### *Group IV. Utensils of Different Types*

*Fishhooks* (Fig. 17*l*)

A big and strong fishhook from Ban Kao is already described above.

*Discussion.* From Ban Kao there are a number of smaller fishhooks made from bone; this one represents the same type as those of bone, but advantage has apparently been taken of the possibility to make it larger in iron than it can possibly be when made of bone. The fishbone collection from Ban Kao includes a number of vertebrae from freshwater fishes of a size that could have been caught on hooks of this size. But similar-sized fishes caught in the rivers today are usually either trapped or taken by netting. Thus it is more logical to believe that this huge hook was used for saltwater fishing. That there were contacts with the sea is evidenced by the abundant fragments of turtle shells. As mentioned earlier, the barbed spearhead (Fig. 17*j*) might also have been used for fishing. Considering and comparing the size and strength of the fishhook and the barbed spearhead, both implements

very well may indicate the existence of an inland community supplying the diet or the economy with saltwater fish.

*Spade* (Fig. 19*b*)

Classified as a spade is a fragment of an iron tool from Tam Ongbah, which is characterized by a blade most of which is now missing, the upper end of which has rounded shoulders from which extends a short, strong, square-sectioned tang. Length of tang 7 cm; width of blade 5 cm; side of tang 1 cm.

*Discussion.* The classification of this fragment as a spade may appear arbitrary. However, its similarity to some iron tools from Northeast Thailand that have been classified as spades is so striking (Solheim and Gorman 1966: Pl. VII*d*, Pl. XXIV*g*) that the use of this term here seems justified. Whether the type actually has served the function of a spade cannot be determined from this fragment.

*Reaping tools* (Figs. 17*b1,b2,d,g*; 21*d*)

The five reaping tools are of three different types. One is from Tam Ongbah, and the others are from Ban Kao.

*Type 1* (Fig. 21*d*). From Tam Ongbah. A curved blade with rounded tip and cutting edge almost parallel to back of blade. Short rectangular-sectioned tang. Briefly to be described as a miniature sickle. Length of blade 4.5 cm; width of blade 1 cm; length of tang 1.8 cm.

*Type 2* (Fig. 17*d,g*). From Ban Kao. Asymmetrical blade with almost straight cutting edge, pointed tip, and back of blade curved in obtuse angle. Short rectangular-sectioned tang. One complete and one fragmentary. Length of blade 4.5 cm; width of blade 1.8 cm; length of tang 1.7 cm.

*Type 3* (Fig. 17*b1,b2*). From Ban Kao. Two small rectangular flat pieces of iron with slightly incurved cutting edge along one long side. For further detailed description see above.

*Discussion.* The reaping knife from Tam Ongbah was recovered from an intact deposit in Hall 4, without any association to burials or coffins. The fact that it resembles a sickle and could be described as a miniature sickle might lead to an interpretation of the tool as being a child's toy. However, there is nothing extraordinary about its size, as compared to the sizes of the other reaping knives, to justify this interpretation. The Type 2 reaping knife bears some resemblances to knives, but the wear of the cutting edges is actually typical of reaping knives. The Type 3 reaping knives might look like nothing but fragments of something. However, identical knives are actually still in use among certain groups of mountain farmers, such as those in the Sri Sawat area of Changwat Kanchanaburi (L. Rishøj Pedersen 1969: 66).

*Hairpin* (Fig. 4,*10*)

A cylindrical iron pin, pointed at one end, slightly curved lengthwise, broken at other end. The fracture seems to indicate that the head of the pin may have been rolled up into a spiral. Length of pin 11.3 cm; diameter 0.3 cm.

## Absolute Chronology and Cultural Significance

The history of Ongbah Cave as a site for prehistoric human activities is clearly divisible into three periods:

1. A period of "Hoabinhian" occupation, which can at least be subdivided into three main occupational periods, covering a time span of about 2000 years between 9230 ± 180 B.C. and 7400 ± 140 B.C.
2. An as yet undetermined period, as far as dating in absolute terms is concerned, where the cave was used as a burial place by a "neolithic" population indisputably related to the Ban Kao Culture. This period clearly represents a phase later than those found at the Bang site, Ban Kao itself, but in relative chronological terms is closer to the Lue sites, Ban Kao, to the Nong Chae Sao find, Changwat Radburi, of the Second Thai-Danish Prehistoric Expedition 1965–66, and to the finds from North Malaysia (Sørensen 1972: 459).
3. A second period of burying in the cave by a bronze/iron-using society. The beginning of this phase, as mentioned above, cannot be much later than 300 B.C., whereas its termination date remains unrecognized.

### *Ongbah Period One*

Although it is not within the aim of this paper to discuss the traces of earlier use of Ongbah Cave, it is felt necessary to stress that this is the only evidence of occupation observed in the cave. The dates fit perfectly well with those of Spirit Cave, Changwat Mae Hongson, as correctly pointed out by Gorman (1970: 103).* However, as distinct from Spirit Cave, no evidence of an early agriculture was observed from these layers at Ongbah.

### *Ongbah Period Two and Ban Kao*

Pottery associated with Burials 3 and 4, particularly representing development of the Ban Kao Culture types 5 and 15 (Sørensen 1972: 479), but further associated with such typical and typologically later types as the Tengku Lembu "Trumpet-shaped Vases" (Peacock 1959: 143, Fig. 14*e*), clearly distinguishes these burials from the nearby simple interments with iron implements.

Of these Ban Kao Culture-related burials, numbers 1, 3, and 4 were obviously disturbed by coffin burials. This fact is taken as evidence that (a) within the Ban Kao Culture there was no tradition of surface markings of the individual burials, as has already been pointed out (Sørensen 1967: 65), and that (b) the coffin burials and their contemporary simple interments are later. This is worth bearing in mind in consideration of the doubts recently published about the Ban Kao sequence and its dating (Solheim 1969: 127; Bayard 1970: 140). Attempts have been made to apply an Early Metal Age dating to the whole complex, basically by simplifying the geographical orientation given for the individual burials, which allows for "the separating out of an 'Oldest group' with a common geographical orientation," which

* It was accordingly very surprising to read Gorman's recent report on his survey of the Mae Nam Khwae Yai valley, where he quotes ages for these layers as being "ca. 13,500 years ago" [Gorman 1972: 138], and later on that these dates should be the earliest from Thailand. Gorman has himself gotten earlier dates from Spirit Cave. This is only one of the inaccuracies in the report.

should also prove the presence of a "horizontal stratigraphy" (Solheim 1969: 128). However, it also proved impossible to find "horizontal stratigraphy" for the subsequent four phases suggested, the purpose of which ultimately seems to have been the incorporation into the sequence of the two burials containing iron tools. However, on re-examination of the measured geographical orientations of the burials under discussion, the present writer found no evidence for this separation-out of an "Oldest group." And, after all, only 400 square meters of the approximately 8000 at the Bang site were excavated. Bayard (1970: 140) finds further support for a late dating of the Ban Kao Culture from "a thermoluminescence date on black pottery from one of these burials." However, to quote the original publication of this date, "Ban Kao, Sample No. 102, excavated? Surface? 290 ± 255 B.C. . . . The single Ban Kao date is probably not to be trusted—not only is the provenience of the tested sample uncertain (it may be a surface find) but there are solid grounds for believing that Ban Kao is earlier than the 3rd century B.C." (Bronson and Han 1972: 322, 323). Concerning Ban Kao it may further be added that (a) the Ban Kao Culture in Ban Kao is represented by several sites (Sørensen 1967: 7), (b) at least one of the sites excavated in 1961–62 represents a phase of the culture later than the late subphase ascertained at the Bang site (Sørensen 1972: 488, Table 3), and (c) others have been excavating at both the Bang site and other sites in the area. One site (personal communication from Chin You-di) had "beads similar to those from U-Thong." With all this uncertainty about the specimen submitted for dating, extreme caution should perhaps be exercised before taking the date as supporting anything at all. However, I find it unnecessary to continue this discussion as long as the settlement finds from the Bang site and the Lue sites are still not published, and as long as almost no data or evidence is presented from Non Nok Tha, other than that of bronze/copper molds and C-14 dates.

At the Bang site the late subphase seems to have come to an end at about 1300 B.C. No less than five C-14 dates from excavation layers 6 and 7 (depending on which square they were collected from), but all within the range of 200 to 230 cm B.D., give the years 1300 to 1360 B.C. Most likely the occupation then continued either within another area of the Bang site itself or at the nearby Lue sites.

As the pottery of the Lue sites, and here particularly site 2, is typologically closer to the "neolithic" pottery from Ongbah Cave than to that of the Bang site, it presumably dates from this side of the 1300 B.C. boundary at the Bang site. Accordingly, an estimate based on the time taken for the changes in the pottery between the early and late subphases at the Bang site would place the Lue site 2 between 1300 and 1100 B.C., and the Ongbah pottery just around 1100 B.C., as indicated previously (Sørensen 1972: 488, Table 3). If this holds true, there is a chronological gap between the "neolithic" use of Ongbah Cave for burial purposes and the use of the cave for similar purposes by bronze/iron-using communities. This gap is closer to 700 years than to 500 years.

### *Ongbah Period Three*

As was previously mentioned, only the C-14 date from the burned coffin is reliable. From this alone it would be impossible to state whether it represents the beginning or the end of the second phase of burying, or is merely an intermediate date.

However, boat/coffin burials are known from elsewhere in Southeast Asia. A rather similar coffin in the Niah caves (Solheim, Harrisson, and Wall 1959: 168) gave a C-14 date of 2460 ± 65 B.P. or 505 B.C., while a similar coffin from Kuruswanan Ledge, Tabon caves, the Philippines (Fox 1970: 173) was dated by other means to the late 13th or early 14th century A.D. In Szechwan boat-coffin burials are known from Chia-ling-kiang, and from Chungking on Yangtze-kiang (Szechwan Ch'uan-kuan Tsang Fa-shüeh Pao-kao 1960). These burials obviously owe their origin to the wooden chamber graves of the Ch'u state, and thus could hardly be earlier than the 6th century B.C., whereas the latest of these burials are dated by the presence of Pan Liang coins, which were first issued after the unification of China under Ch'in in 221 B.C. From this evidence there is good reason to believe that the wooden boat coffins at Ongbah came into use well before 230 B.C., and that this tradition may have continued for quite some time thereafter. Any suggestion as to how long the tradition lasted would simply be speculative.

The cultural significance of these finds from Ongbah Cave exceeds that of the immediate impression left by the finds. Obviously the two related and yet different sets of burials with iron artifacts reflect two socioeconomic levels of a population which probably lived nearby, but whose settlement remains undiscovered. Thus the wooden coffin burials undoubtedly belonged to an upper class which for centuries were buried in this way with at least a part of their accumulated wealth, for example, with their kettledrums. This brings right into focus Gühler's description of the history of the kettledrum in his possession (1944: 25). At a lower social level, but still of a certain social status, were the persons buried in the simple interments. From the composition of their associated tools they may have been skilled handworkers such as carpenters and blacksmiths, whereas other laborers and local farmers probably never were admitted to burial in the cave.

One should expect the settlement of this population to be quite extensive, since it was able to contain three or more stratified social levels. The economic basis of the society is of course unknown, but it must have been of quite some importance in order to support the society, and to allow at least its leaders to accumulate the wealth which probably once was contained in the wooden coffins and which is represented by the kettledrums. It is not unlikely that the economic basis might have been the nearby lead mines. The owner of the mines once told me that many years ago, when one of the mines was being opened, there were found some tools and what he thought could have been crucibles. However, these artifacts had not been kept. More light may be shed on this interesting question in the near future. With the use of radioactive lead isotopes, an attempt will be made to determine whether the lead of the bronze drums from the cave is the same as that of the nearby mines. If so it means that the drums were probably made locally. The drums themselves reveal through their decoration of geometrical patterns and naturalistic elements that in many respects they seem to be intermediate between the Heger I drums of the Mainland and those from Indonesia (Sørensen 1973), and in fact share more elements with the Indonesian drums than with the Mainland ones. It is of further importance to notice that Marschall (1968: 29) does not think that any of the Indonesian drums were made in Indonesia, but rather that they were imported. The distribution of kettledrums in Indonesia (Marschall 1968: Karte 1) favors a dispersal from the western part of the Mainland sooner than from the

Dong-so'n area, as could otherwise be expected. There is further support in the fact that decorations on the Ongbah drums correlate most closely with those of such eastern and southern drums as Saleier, Roti, and Kati.

A similar route of dispersal of influences might have brought the idea of boat coffin burial from Szechwan, with western central Thailand as transmitter, to Niah and ultimately to the Philippines. While external relations can be recognized for some parts of the finds from Ongbah Cave, very few external relations indeed have been observed for the iron tools. Typological correlations can be established between the iron tools from Ongbah and the few pieces from Ban Kao. However, there is a marked difference in the contents from the two sites. Thus the pieces from Ban Kao rather reflect the needs of an agricultural society, as may be seen by comparing the totals in Table 1.

TABLE 1. CLASSIFICATION OF IRON IMPLEMENTS FROM TAM ONGBAH AND BAN KAO

| GROUP | SUBTYPE | ONGBAH | BAN KAO | SUBTOTAL | GROUP TOTAL |
|---|---|---|---|---|---|
| *I—weapons* | | | | | |
| lances | | 1 | | 1 | |
| spearheads | | 2 | (1) | 3 | |
| arrowheads | 1 | 2 | | 2 | |
| | 2 | 1 | | 1 | |
| | 3 | | 1 | 1 | |
| halberds | | 1 | | 1 | |
| socketed | 1 | 1 | | 1 | |
| axes | 2 | 1 | | 1 | |
| | | | | | (2) 11 |
| *II—woodworking tools* | | | | | |
| tanged axes/adzes | | 1 | 1 | 2 | |
| chisels | 1 | 6 | 1 | 7 | |
| | 2 | 3 | 3 | 6 | |
| | 3 | 4 | | 4 | |
| intermediate between 1 and 3 | | 3 | | 3 | |
| hoes | | 6 | | 6 | |
| grooving tools | | 1 | | 1 | |
| carving tools | | 1 | | 1 | |
| | | 1 | | 1 | |
| | | | | | (4) 31 |
| *III—knives* | | | | | |
| single-edged straight back | 1 | 3 | | 3 | |
| single-edged curved blade | 2 | 1 | | 1 | |
| double-curved blade | 3 | 1 | | 1 | |
| double-edged short tang | 4 | 2 | | 2 | |
| double-edged blade bent | 5 | 4 | | 4 | |
| | | | | | 11 |
| *IV—utensils* | | | | | |
| fishhooks | | | 1 | 1 | |
| spades | | 1 | | 1 | |
| reaping knives | 1 | 1 | | 1 | |
| | 2 | | 2 | 2 | |
| | 3 | | 2 | 2 | |
| hairpin? | | 1 | | 1 | |
| | | | | | (5) 8 |
| *total implements* | | | | | 61 |

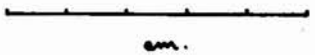
A survey of the literature presently available to this writer for similar types of iron tools both from Thailand and the rest of Southeast Asia, from the Mainland as well as from the Archipelago, has revealed astonishingly few points of similarity between the Ongbah/Ban Kao collections and those of other areas. The Tam Nguang Chang Cave find (Watson and Loofs 1967: 260) had bronze axes and a stray iron tool, but no connection can be recognized.

With the iron tools from the Lam Pao and the Lam Pla Plerng surveys (Solheim and Gorman 1966: 111) a few insignificant relations can be established. From the pictures, the tanged spades? from LP 2 and NP 5 (Solheim and Gorman 1966: Pls. VII, XXIV*g*) slightly resemble OB 105 (Fig. 19*b*), although the possibility cannot be excluded that the latter might be the tang/shoulder end of an iron sword. Also, the knife from NP 6 (op. cit., Pl. XXV*ii*) resembles slightly the reaping knives of Ban Kao Type 2, Figure 17*g*.

Outside of Thailand but within the Mainland no convincing correlations can be established at the moment. Thus neither the Malaysian collections (Sieveking 1962: 79) nor the finds from Dong-so'n (Janse 1958) or other places in Vietnam, Cambodia, or Laos offer anything comparable. Slight resemblances may be found in the shape of the blade of the knives from Ongbah and those from the Szechwanese boat burials (Janse 1958: 47), but it all remains at a very general and insignificant level.

More or less the same pattern is repeated in the Archipelago, where the most similarity is found in the iron age collections from the Philippines (Solheim 1964). The bell in Solheim's Plate 27*p* is similar to Figure 22 from Ban Kao, while the spiral bronze armrings of Solheim's Plate 35*b* can be matched from the Ongbah collection. Unfortunately these are too fragmentary to allow reconstruction even in a drawing. Solheim's Plate 47*e*, a straight-backed knife with short tang, resembles Type 1 of the knives, here shown as Figures 9,*1* and 21*b,c*, while his Plate 47*v* is close to reaping knives of Type 2 as shown in Fig. 17*d,g*, both from Ban Kao. The chisels of Plate 48*b,c,d* (op. cit.) seem from the pictures to resemble somewhat the Ongbah chisels. There is also some similarity to OB 109 (Fig. 20*f*), which, as has been mentioned, was difficult to fit typologically into any of the other groups ascertained in the Ongbah/Ban Kao material.

Even if it appears rather difficult to establish any long-distance connection between the iron tools of the Southeast Asian region, the reason for which is most certainly their local origin and manufacture, one identity between the finds from Thailand and those from the Philippines emerges clearly. In these two widely separated areas there is extensive use of tools with a tang, while the other areas surveyed in this connection predominantly have tools with a socket. The reason for this remains undiscovered so far, but could perhaps be found in the lineage of influences described earlier in connection with the kettledrums and the boat coffin burials. Whether it is so or not remains a hypothesis. More evident—at least as far as the Ongbah/Ban Kao collections are concerned—are the similarities between the iron tools and the tools of bone, stone, and shell found in the Ban Kao Culture. Here it suffices to point to the similarity between the arrow of Bang site Burial 8 (Sørensen 1967: Pl. 23*A.7* and Pl. 125*c*) and the fishing spear? of iron from the same site, shown in Figure 17*j* of this article. Chronological gaps seem to exist, as shown above, between the iron age horizon at the Bang site and the underlying



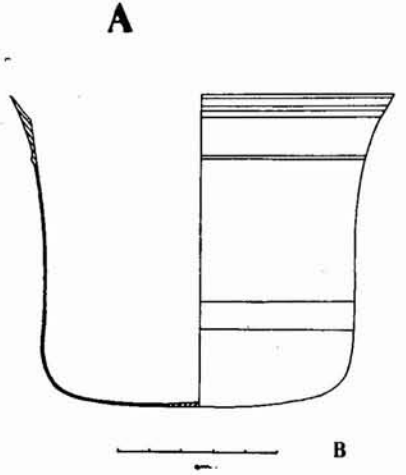




Fig. 22 Bronze bell *(a)* from the Bang site and vessel from Tam Ongbah *(b)*.

Ban Kao Culture, a pattern which seems to be repeated in Ongbah Cave between the two burial phases. Nevertheless, it is clearly shown that the iron age community of this area had the Ban Kao Culture as its foundation, and thus that the Ban Kao Culture may ultimately be linked with the protohistoric period.

## References


Bayard, D.
1970 Excavation at Non Nok Tha, Northeastern Thailand, 1968: an interim report. *AP* 13: 109–144.

Bronson, B., and M. Han
1972 A thermoluminescence series from Thailand. *A* 46: 322–326.

Fox, R. B.
1970 *The Tabon Caves. Archaeological Explorations and Excavations on Palawan Island, Philippines.* Monograph of the National Museum, no. 1. Quezon City.

Gorman, C.
1970 Excavations at Spirit Cave, North Thailand: some interim interpretations. *AP* 13: 79–108.
1972 Inundation of archaeological sites. Ecological reconnaissance of the Quae Yai hydro-electric scheme. *Asian Institute of Technology*, 1972, pp. 131–145.

Gühler, U.
1944 Studie über alte Metall-Trommeln. *Journal of the Thailand Research Society* 35(1): 17–71.

Janse, O.
1958 *Archaeological Research in Indo-China.* Vol. III. Bruges, Belgium: Institut Belge des Hautes Etudes Chinoises.

Marschall, W.
1968 Metallurgie und frühe Besiedlungsgeschichte Indonesiens. *Ethnologica* N.F. 4: 29–263.

Peacock, B. A. V.
1959 A short description of Malayan prehistoric pottery. *AP* 3(2): 121–156.

Pedersen, L. Rishøj
1969 Ris og religion i Thailand [Rice and religion in Thailand]. In *Thailand: Arkaeologi, Etnografi, Historie*, pp. 63–77. Scandinavian Institute of Asian Studies.

Sieveking, G. de G.
1962 The Iron Age collections of Malaya. *JMBRAS* 29(2): 79–138.

Solheim II, W. G.
1964 *The Archaeology of Central Philippines. A Study Chiefly of the Iron Age and Its Relationships.* Monographs of the National Institute of Science and Technology, no. 10. Manila.
1968 Research report: early bronze in northeastern Thailand. *CA* 9(1): 59–62.
1969 Review article. *AP* 12: 127–130.

Solheim II, W. G., and C. Gorman
1966 Archaeological salvage program: northeastern Thailand—first season. *JSS* 54(2): 111–210.

Solheim II, W. G., B. Harrisson, and L. Wall
1959 Niah "three colour ware" and related prehistoric pottery from Borneo. *AP* 3(2): 157–166.

Sørensen, P.
1967 *Archaeological Excavations in Thailand.* Vol. II. *Ban Kao.* Copenhagen: Munksgaard.

1972 The Neolithic cultures of Thailand (and North Malaysia) and their Lungshanoid relationship. In *Early Chinese Art and Its Possible Influence in the Pacific Basin*, edited by Noel Barnard, vol. 2, pp. 459–506. New York: Intercultural Arts Press.

1973 The kettledrums from Tam Ongbah. *Archaeological Excavations in Thailand*. Vol. IV.

*Szechwan Ch'uan-kuan Tsang Fa-shueh Pao-kao*

1960 Peking: Wen Wu Press.

WATSON, W., and H. H. E. LOOFS

1967 The Thai-British Archaeological Expedition. A preliminary report on the work of the first season 1965–66. *JSS* 55(2): 239–272.